The FOUNDRY

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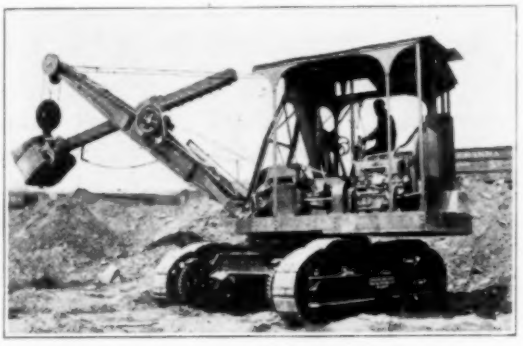
When You Want To Dig Dirt, Call on Castings

THE rather lazy feeling that has been so noticeable during the past few weeks and the boast of a neighbor that he saw a robin this morning, whisper the welcome news that Spring cannot be far away. As the frost leaves the ground, the farmer becomes anxious to get the soil prepared and the seeds into the ground, while the contractor, who also must necessarily accomplish the



Rigidity and Resistance To Wear Result From Using Cast Parts

greater portion of outdoor work in the warm months, sends steam shovels electric and gasoline excavators to the rescue and the dirt literally begins to fly. Great progress has been made in methods of removing dirt in digging foundations for the modest residence or the tallest skyscraper. Just a few years ago, making an excavation of any size required an army of men and many horse drawn wagons, but today the mechanical digger, which is handled easily by one man, pulls out a cubic yard or more with each dip of the bucket and keeps a small fleet of trucks busy. Use of steel castings in the construction of various types of excavating equipment is a feature which permits rough usage under strenuous working conditions. Such parts as frames, racks, gears, corduroy shoes, dipper teeth and the car body are made in the foundry. Various parts of the driving mechanism, such as the steam engine, gasoline engine and electric motor, also are cast.

Find Where Castings Can Be Sold

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ACCOUNT NO._____ SHEET NO._____

ACCOUNT

Debits

DATE 19__	MEMORANDUM	REFERENCE	DEBITS	CREDITS	BALANCE DEBIT	BALANCE CREDIT

PUTTING YOUR PATTERNS

FOUNDRIES often underrate their pattern departments. The owner of a large eastern jobbing foundry when interviewed recently on the subject of pattern storage, said that he disapproved emphatically of any elaborate storage system. He said with an up-to-date pattern shop new patterns could be made from engineering drawings, in the time frequently spent in searching through a stock of patterns accumulated during a period of from 10 to 30 or 40 years. Further, he said, it is poor practice for a modern foundry to assume that it will want to gate its castings in exactly the same way today as it did many years ago. This particular man made it a practice to destroy patterns after 5 years, if there had been call for them in the interval.

Pattern storage is a more or less troublesome problem with many foundries. If a proper charge is made for storage space in a modern fireproof building, if plant overhead is distributed to the pattern storage, and all other charges such as insurance, heat, watchman's salary, etc., are made properly, the cost of keeping old patterns ready to use in case they should be needed apparently is prohibitive.

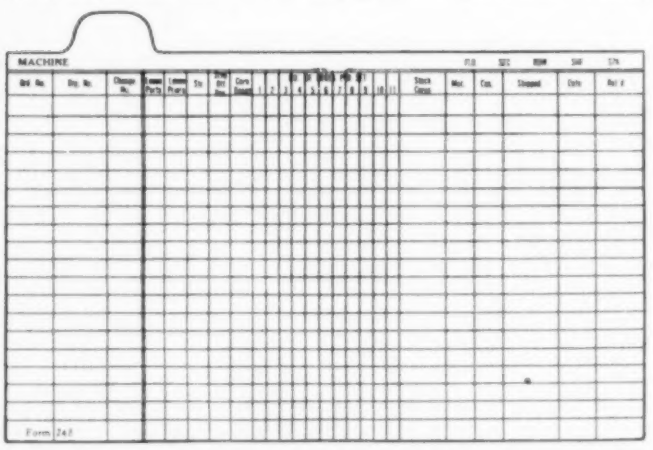


Fig. 1—A card of this form records the location of each pattern

Like the Man Who Saved String?

Anyone who has spent much time among jobbing foundries must have heard repeatedly the story of the customer who, after 20 years' silence, sent in an emergency order for a large gear. According to the usual story, the pattern for this gear had not been touched during the intervening 20 years, but the foundry superintendent located it readily and within two days the new gear was on its way by express to the customer, thus saving him several thousand dollars, because his plant otherwise would have been shut down for a week.

Such a story sounds romantic, and undoubtedly occasionally is founded on fact. The important question is—Was it good business?

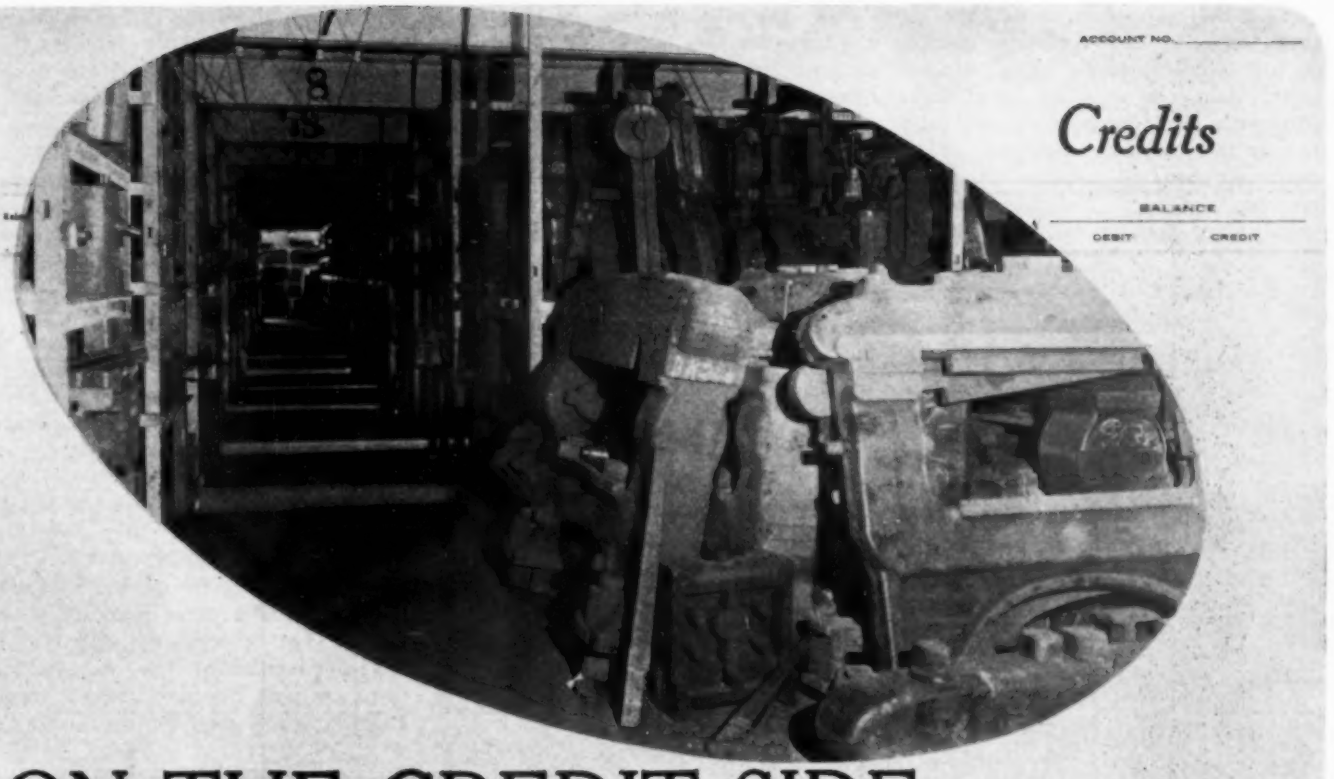
How much credit does a foundryman get for being able to locate a pattern after 15 or 20 years?

Is he able to charge enough for the new castings to pay for pattern storage through all those years?

Does he know what the storage charge on that particular pattern is? In other words, does he run his pattern storage department as a business?

The Farrel Foundry & Machine Co. carries on the business of pattern storage as one distinct part of its large plant at Ansonia, Conn. The department occupies a 4-story stone building which to reduce fire hazard is located at some little distance from the remainder of the plant.

The man in charge of the operation of this building virtually conducts a distinct enterprise, which must be self-supporting. Patterns which



ON THE CREDIT SIDE

By Herbert R. Simonds

enter the building for storage must pay storage charges, and in addition must pay an extra fee every time they are taken out and returned to storage. In many respects the whole scheme of operation is similar to that of an independent warehouse storing general commodities.

Fills Threefold Purpose

The business of this pattern storage department at Ansonia covers three features:

Storing or holding the patterns.
Service. That is, the ability to deliver a casting from any pattern promptly when needed.
Care and repairs of patterns.

The first of these is the simplest. If there is room enough, it is easy to put a pattern away and hold it for any length of time. This merely involves checking it in so that the proper charge can be entered each month.

The difficult part of the pattern storage business comes under the second heading. An extensive and efficient system of records is necessary to be prepared to deliver promptly to the foundry at any time any one of half a million patterns. It also is necessary to exercise scrupulous care in storing and placing patterns on the shelves, and in keeping the entire warehouse clean and free from various disturbing elements.

The filing system at the pattern storage department of the Farrel Foundry & Machine Co. is the card index type. It is contained in cabinets in the office of the pattern foreman, which is on the first floor of the building. Whenever a new pattern is needed, the procedure is as follows:

The engineering department makes out detailed working drawings, which are sent to the foundry foreman for his approval. When these drawings are correct, they are sent to the pattern shop, and the pattern is made and usually sent directly to the foundry. At the time the original plans are made in the engineering department, a card is partly filled in, giving the pattern a ma-

ORDER NO.	FOR			DATE
MAKE	PATTERN NO.	PART		
LOOSE PCS.		STOP OFF PCS.	STOP OFF	
LOOSE PRINTS		SIZE STICKS	DRAW	
CORE BOXES		NAME PLATE	FACE	
STRIKES			CORE	
MAN'S NO.	START	STOP	TOTAL	
UNFINISHED		NUMBER MADE		

Fig. 2—This record tells the men in the warehouse what patterns to deliver

chine number, that is, a number corresponding to the complete machine or tool which is to be made. Usually more than one casting, and therefore more than one pattern, are called for in the complete machine. These patterns then all contain the same machine number. On this card the engineering department puts the order number, the drawing number, the number of loose parts, loose prints, and the number of coreboxes.

When the foundry has finished the job, the patterns are gathered together, each one marked with the machine number. Then all cards with this number are sent down from the engineering department, and are taken with the patterns to the pattern storage. These cards then become a part of the permanent file records of the pattern storage department.

The pattern foreman on receipt of each card and its pattern fills in the letters and figures which describe the place where the pattern is to be stored. Thus a card will show, for instance, that a pattern is located on the third floor, section E, row 25, shelf 3, and space 18. Fig. 3 gives an idea of the arrangement for storing small patterns. The shelves are numbered from the top down 1, 2, 3, 4, 5, and 6. The spaces are numbered with uneven numbers on one side of the aisle and even numbers on the other.

Arrangement of the file card is shown in Fig. 1. When a card is first put into the files it is stamped with a date, and from that time on a rental or storage charge accrues against the pattern as long as it is in the department.

When a pattern is wanted in a foundry, a requisition is made listing the machine number and giving an order number against which storage and service charges may be entered. This requisition goes to the storage house. The file clerk then takes out of the files all of the file cards having the designated machine number. Each of these cards corresponds to a particular pattern, but these patterns may be, and usually are, located at different places in the building.

Several reasons make this separate storing necessary. One is the economy of space and convenience of having similar parts stored together. This grouping of similar classifications is shown in Fig. 3.

The file clerk makes out a card for each pattern desired. The form of this card is shown in Fig. 2. These cards are in four different colors, green, red, yellow and white. As soon as they are made out, they are placed in a rack just outside the storage office where they are seen by the men who collect and store the patterns. The red card indicates a rush order, and takes precedence over any of the other colors.

The business of the storage men is to see that the card rack is empty. Each storage man must charge his time against some order number. When he is working collecting patterns, he charges his time against the order number on which the pattern requisition is based. At other times he uses a general order number which

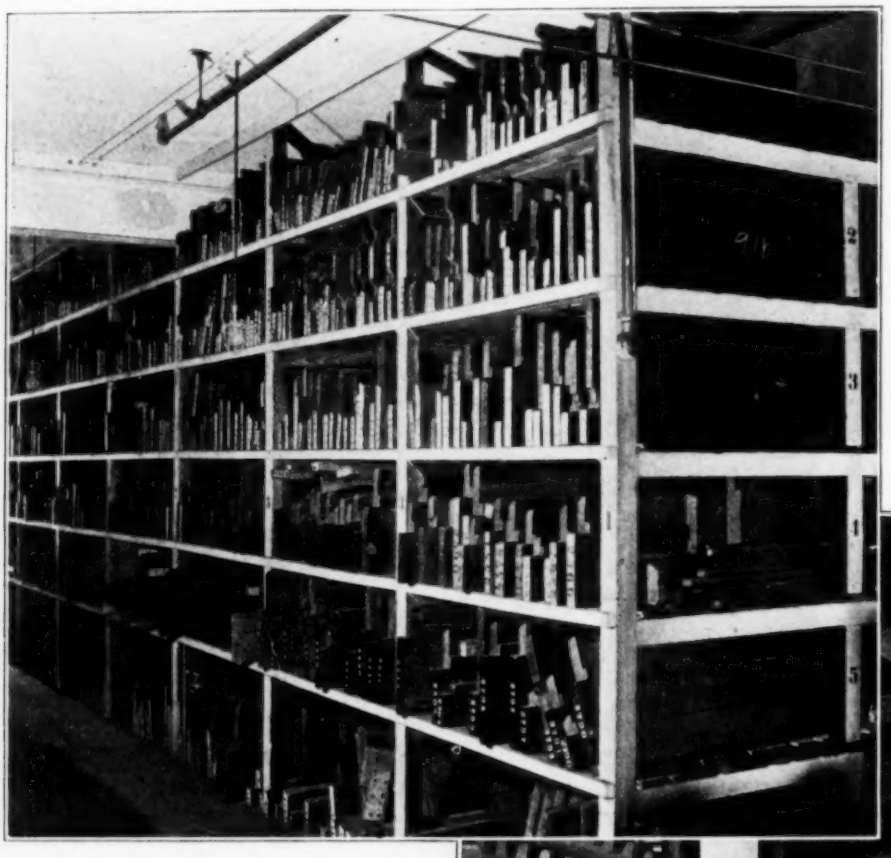


Fig. 3—Similar patterns are grouped together

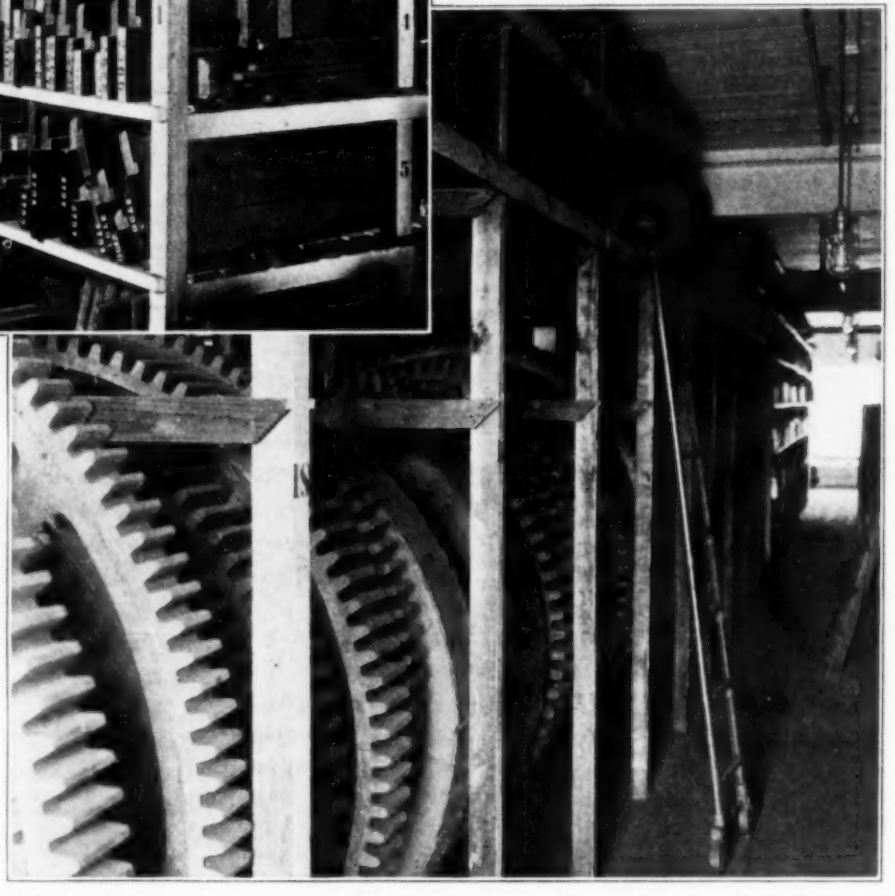


Fig. 4—The aisles are arranged to end opposite windows—Note the assemblage of similar patterns in the same classifications

goes against the storage or rental account.

The lower space on the delivery card, which is the card shown in Fig. 2, is filled in by the man who collects the patterns. When he first takes the card down from the rack, he enters on it his individual number and the time of starting. After completing the work, he puts in the time he stops and the total elapsed time.

ORDER NO.	
PATT. NO.	
MAKE	
CORE BOX NO.	OF
CORES PER SET	
MAN'S NO.	
TOTAL TIME	ON
UNFINISHED	
65	

Fig. 5—Each pattern as it goes to the foundry from the storage building has tag of this character attached

This last item he may omit if he is rushed with work. It is then computed in the office.

The green delivery card is used for replacement patterns, and the white delivery card is used when no machining is called for on the finished casting. Other cards are used for other purposes. Repair work on a pattern calls for its separate card. Also, each pattern as it leaves the storage for the foundry has a small tag tacked to it giving the order number on which it goes out and other necessary information. This card is shown in Fig. 5.

Has Crane and Elevator

The method of storing patterns throughout the large building has been studied carefully. The entrance of the building, which is at one end of the first floor, opens upon a space served by a 2-ton electric traveling crane. At one side of the entrance a freight elevator connects with all the floors. Heavy, irregular shaped patterns are stored on the first floor. Heavy patterns which can be classified as to shape, such as end frames, shaft hangers, pulleys, gears, etc., are stored on the second floor. Patterns for small parts in frequent use are stored on the third floor of which Fig. 3 gives an example. The fourth floor is given over to old and seldom needed patterns.

Shelves Are Whitewashed

All shelving and woodwork is whitewashed and the entire building is kept scrupulously clean. It is equipped throughout with an automatic sprinkler system, and is wired so that electric drop lights serve every inch of the entire shelf space. The aisles between the storage shelves are arranged to end at opposite windows so that in the daytime nearly all parts of the building are lighted without the use of electricity. Each lateral aisle branching off of the main aisle has its individual switch which turns on its row of drop lights.

Each pattern is given an individual number, which indicates the exact location of its storage space. Wherever possible these numbers are stencilled on the end or side of the pattern, which would naturally be exposed as the pattern is placed on the shelf. Nearly all the patterns shown in Fig. 3 have numbers which may be read by a man standing in the aisle. These numbers are kept in good condition. If they come back from the foundry partly worn off, it is the duty of the man who places them in storage to restencil them.

The intention of the management is to have the pattern storage department self-supporting. That is, the product of the plant must be sold for a price which will include the actual pattern handling and storage cost. For a time a flat rate of $2 a pattern was charged whenever the pattern went in storage. It was found that this worked a hardship on small patterns, and was an inadequte charge for heavy pieces. At present the actual time required to find a pattern and carry it down to the industrial truck, which is to take it to the foundry, is charged as explained. In addition to this a general storage charge is added, based on the amount of space occupied by the pattern and the length of time it is in storage.

Some difficulties are suggested by this scheme. For instance, the customer who orders once in five years has to pay a much larger pattern storage charge than the customer who buys castings every six months.

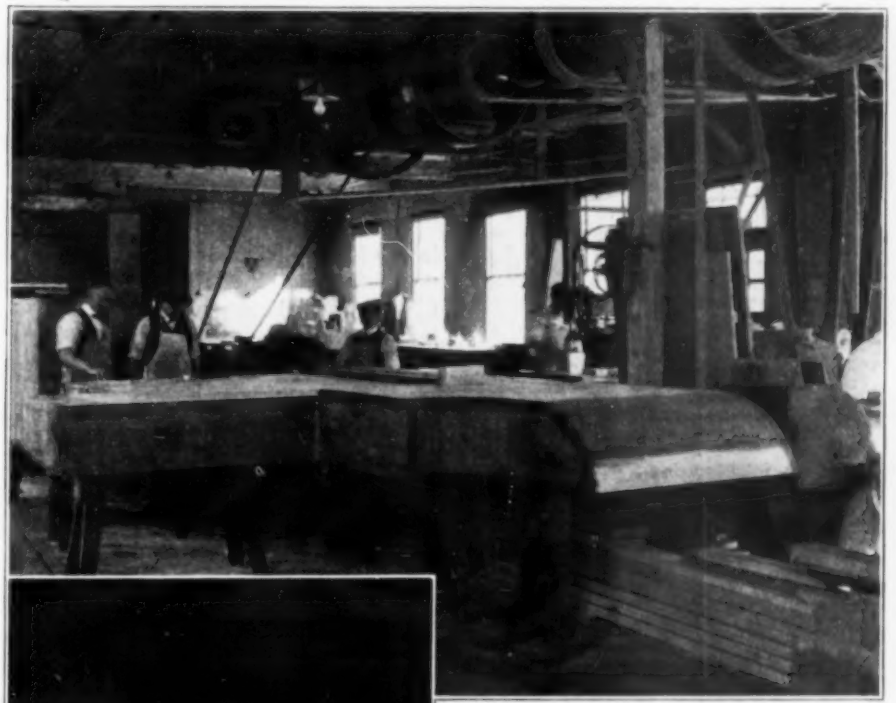


Fig. 6—The character of work in this corner of the pattern shop indicates the extremes of size and the irregularity of the patterns required

Fig. 7—The receiving room is served by a 2-ton electric traveling crane

However, when the nature of the department is explained, customers are quick to see the justice of it. It is manifestly unreasonable for a manufacturer to expect a foundry to give room and care to a large bulky pattern over a period of years without receiving some compensation.

The patterns in the storage house of the Farrel Foundry & Machine Co. date back 50 years or more, but there is some good reason in each case when an old pattern is kept. Usually patterns are scrapped after 10 years without a call. Of course, this involves a loss because the pattern has accrued storage department charges which have to be absorbed. Recently several carloads of old patterns of all kinds were hauled away to be burned. Some of these patterns were examples of the finest kind of cabinet work of 30 or 40 years ago, but there was no help for it as a pattern storage house cannot be used as an art museum.

The storage charges are adjusted so that the operation of the department breaks even. If the books show a profit, the storage rate is slightly reduced, and if they show a loss over any period of time, the rate is increased a little. Of course, the cost of handling and storing patterns, must be met in one way or another by any foundry. Usually it becomes part of the overhead. The Farrel Foundry & Machine Co. has found it more advantageous to distribute it to the individual job on a businesslike basis.

Readers Comment

Note—Material appearing under this head does not necessarily reflect the opinion of The Foundry or of its editors.

Patterns Cause Trouble

TO THE EDITORS:

I read with much interest the answer regarding gear blanks in the Oct. 15 issue of THE FOUNDRY. The subject is large and one that has been a considerable source of trouble to every foundryman who has attempted the manufacture of these castings. The person asking the question stated that dirt and shrink holes appeared in his castings. Our principal trouble and one that is common with every foundryman I have consulted, is just shrinkage. I have taken this subject up with foundrymen all over the country and their experience parallels mine. Chills are used to draw the shrink back from the face so that the cavity will not show at the bottom of the teeth, particularly teeth that are cut to a coarse pitch. This method works satisfactorily only in some cases. Risers on the rim at the arm junctions are not infallible. Even special iron mixtures will not prevent shrinkage cavities in some wheels. My honest opinion is that the only way to prevent this trouble is to insist on patterns properly proportioned to insure a uniform cooling rate. This movement will have to start in the engineering department.

THE FOUNDRY could do a real service by starting a campaign along this line. Publish articles showing engineers where their designs are at fault. Where the foundry gets the blame for defects clearly due to lack of knowledge on the part of the designer. If the foundryman complains, the customer takes the patterns to another foundryman anxious to fill his floors. If he fails in his endeavor to make a satisfactory casting from an ill designed pattern, the customer proceeds to catch another sucker and so on almost indefinitely. Under present conditions, the foundryman has to take all the risk.

WATERBURY, CONN. W. J. Maton

Increase Requirements

TO THE EDITORS:

As makers of large steel castings of alloy and carbon steel, we are interested in the article, "Annealing Steel Castings," by Larry J. Barton, which began in the Nov. 1 issue. Mr. Barton emphasizes the extreme care required to meet the specifications of the Canadian Pacific railway for vanadium steel locomotive frames. Today the physical requirements are still more difficult to meet and are as follows:

	Not Less Than
Yield point	45,000 lb. per sq. in.
Tensile strength	83,000
Elongation in 2 inches	25 per cent minimum
Reduction of area	45 per cent minimum

The specification mentioned by Mr. Barton called for 43,000 pounds yield point and not 45,000 pounds as published in the article. The latest specification has been in force for some time and is being met regularly by Canadian firms.

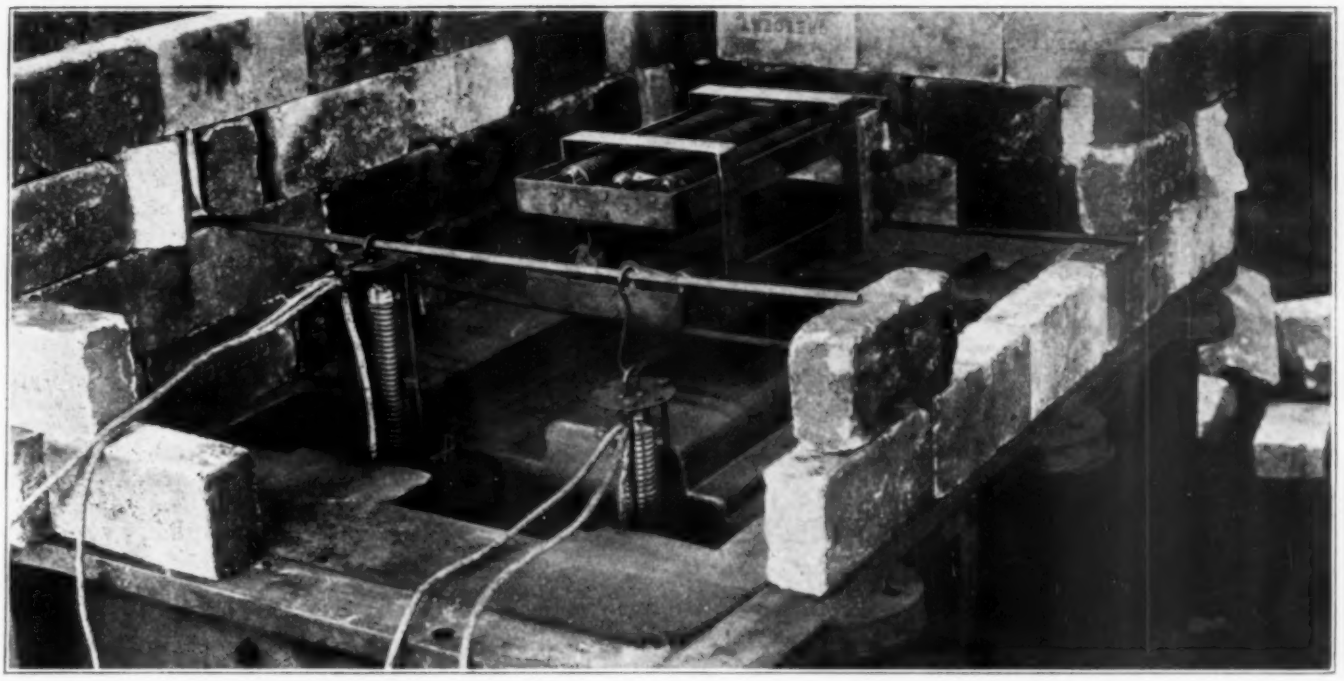
MONTREAL, QUEBEC C. F. Pascoe

Institute of Metals Plans Meeting

Annual general meeting of the British Institute of Metals will be held in London, Eng., March 9 and 10 in the hall of the Institution of Mechanical Engineers.

The following papers have been received: Magnetic Analysis as a Means of Studying the Structure of Non-Magnetic Alloys, by Professor Kôtaro Honda and Professor Hikozo Endo; Brittleness in Arsenical Copper, by Clement Blazey; Influence of Calcium on Aluminum Containing Silicon, by J. D. Grogan, with an appendix on Estimation of Calcium in Aluminum Alloys, by P. G. Ward; Investigation of the Effects of Impurities on Copper, Part V—The Effect of Bismuth on Copper, by Professor D. Hanson and Grace W. Ford; Investigation of the Effects of Impurities on Copper. Part III—The Effect of Arsenic on Copper. Part IV—The Effect of Arsenic plus Oxygen on Copper, by Professor D. Hanson and C. B. Marryat; Examination of a Fifteenth Century Brass, by J. Newton Friend and W. E. Thorneycroft; Application of Strain Methods to the Investigation of the Structure of Eutectic Alloys, by F. Hargreaves; Note on the Crystallization of the Lead-Tin Eutectic, by F. Hargreaves; Mechanism of Inverse Segregation in Alloys, by R. Genders, with an appendix on The Accurate Determination of Copper in Bronze by Electrolysis, by R. A. F. Hammond; Notes on the Manufacture and Properties of Hair Springs, by H. Moore and S. Beckinsale; Penetration of Brass by Tin and Solder, with a Few Notes on the Copper-Tin Equilibrium Diagram, by J. H. Miller; Note on the Silver Contents of Roman Lead from Folkestone and Richboro Castle, by J. Newton Friend and W. E. Thorneycroft; Electric Furnaces in Nonferrous Metallurgy, by D. F. Campbell; Magnesium-Rich Magnesium-Copper alloys, by Max Hanson; An Etching Reagent for Copper by Professor Bernard W. Holman; Penetration of Mild Steel by Brazing Solder and Other Metals, by R. Genders; Attack of Molten Metals on Certain Nonferrous Metals and Alloys, by Harold J. Hartley.

The paper by D. F. Campbell entitled Electric Furnaces in Nonferrous Metallurgy will be the subject in the afternoon of March 9 and will be followed by a general discussion. The annual dinner of the institute will be held, on March 9 and will be followed by a dance. The fall meeting will be held in Derby, Sept. 6 to 9.



Method Of Applying Heaters To The Mold. A Single Unit Is Used In Some Cases

Dries Molds Electrically

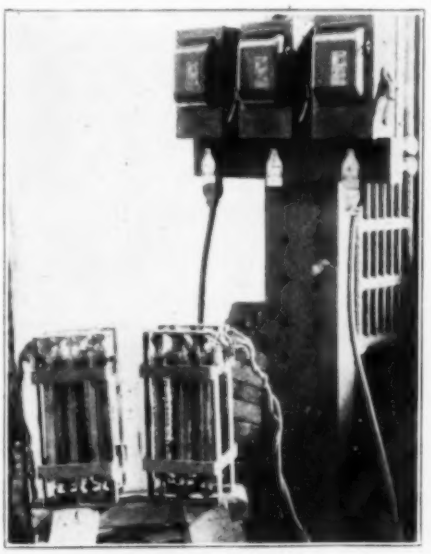
By Frank C. Taylor

FOUNDRIES long have employed numerous methods of drying molds. In some cases the heavy iron flasks are placed in the oven and the moisture expelled from the sand. Another method often employed in drying molds consists of playing a flame from a gas torch on the face of the mold. Gas fired and coked fired heaters also are placed in the molds.

Some time ago, the Gleason Works, Rochester, N. Y., conducted an investigation to determine the best method for drying molds. During the course of the investigation, electricity was suggested as a source of heat, and after some experimenting, the company found electricity exceedingly satisfactory for drying molds.

Heaters used in electrically drying the molds are approximately 18 inches long and 1½-inch in diameter. For normal use, six of these heaters are tied together in an iron frame and operated in series on 230 volts, alternating current, taking approximately 32 amperes, or a total kilowatt capacity of 7.36 kilowatts. Current is supplied heaters through asbestos covered wire connected to a two-wire, rubber covered cable and connection is made to the supply by means of a 50-ampere, two-wire, stage plug in turn connected to a 60-ampere, two-wire safety switch. Ordinarily one of these six-unit heaters is suspended from rods placed on the top of the mold, resting upon the flask. No part of the heater is in contact with the mold; consequently no damage is done to the surface. In some cases where the mold is particularly deep at a certain point, single-heater units are dropped down into the cavity to insure dryness.

This article on drying molds with electricity is abstracted from an article which appeared in a recent issue of Gas and Electric News, published by the Rochester Gas & Electric Co., Rochester, N. Y.



THE HEATERS, PLUGS, AND SAFETY SWITCHES

After the heaters are in place, electrical connections are made quickly by the use of plugs, then bricks are placed on top of the drag and the cope placed on top of these bricks. The separation of the drag and the cope gives more room for the electrical heating unit, room for the asbestos wires, and finally gives an outlet for the moist air and an inlet for the dry air from the room.

For a flask 48 inches wide, 48 inches long and 36 inches deep, it ordinarily is necessary to have the heat on one of these heaters for from 2 to 4 hours to dry the mold sufficiently. Translating this into kilowatt-hours, from 15 to 30 kilowatt-hours are required to dry a mold of this size. The advantages of this method are:

(1) The flask does not have to be moved after the pattern is removed. (2) It is possible to spray the surface of the mold with plumbago and talc so that it is extremely smooth and gives excellent surface to the casting. (3) The even strength of the mold, due to the even drying, gives a casting but slightly different from

the pattern. This results in less chipping, and easier painting. In the case of painting, if the surface is rippled it is necessary to fill in the casting with filler which is softer, of course, than the iron and ultimately may be broken off. (4) A mold may be made, dried and the casting made in one day. This results in a saving of floor space and makes possible a day's saving on rush work. Electricity for this use is eminently fitted since it can be applied just where desired and by using the unit system, in just the amount desired.

High Blast Retards Flow of Slag Stream

Question: We use 25 pounds of limestone on a 600 pound charge of iron in our cupola lined to 23 inches. The slag seems fluid enough when we drop the bottom, but it does not flow freely from the slag hole. The iron is satisfactory until we have tapped about 2000 pounds. After that it is cold and comes slowly. We use 60 pounds of coke to the charge.

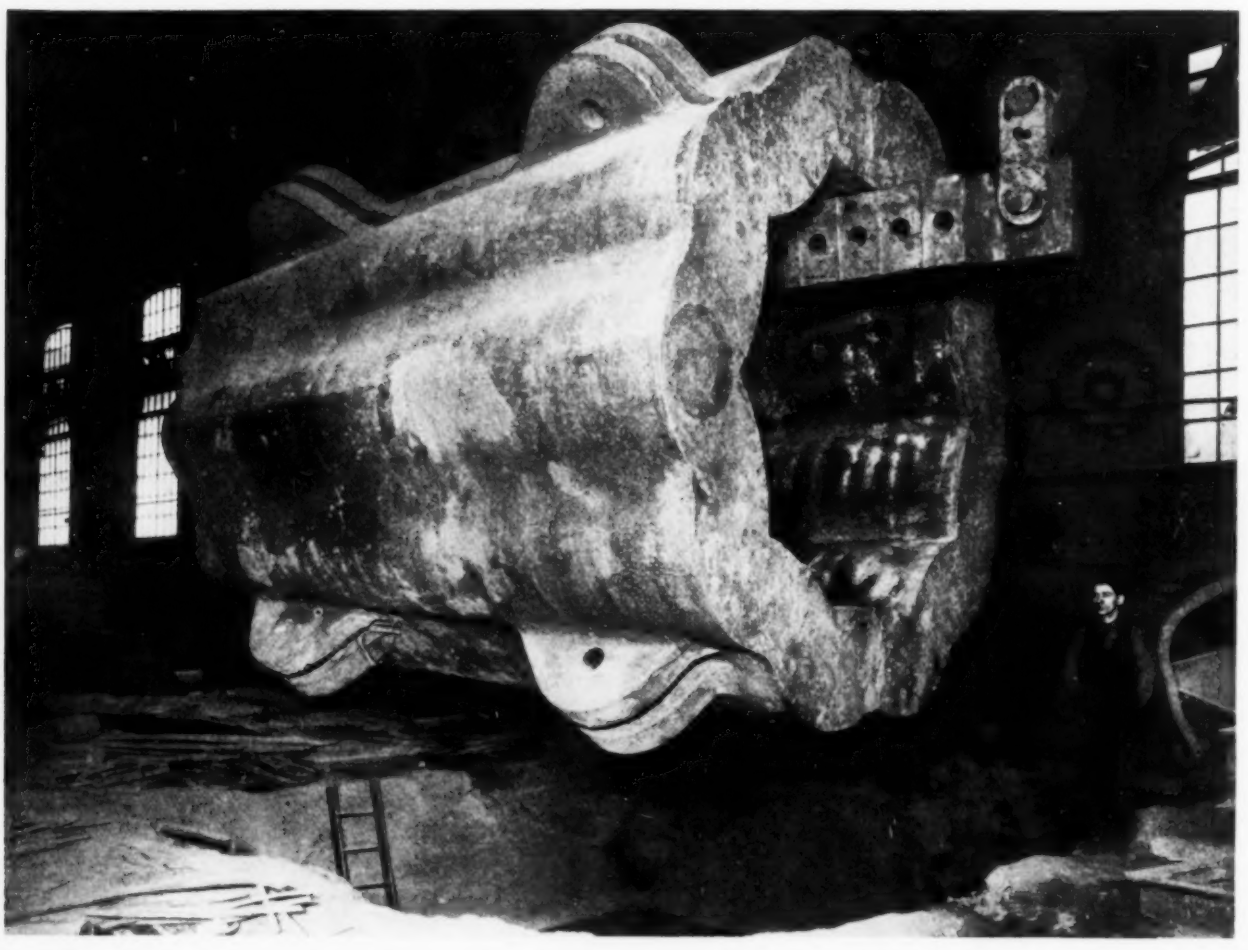
Answer: Your trouble may be due to one or to a combination of two or more causes, including high blast pressure, ill proportioned charges, and poor quality limestone and coke with a high ash content. Since you did not furnish any particulars on these points all we can suggest is that you will have to solve your problem by a process of elimination. From the general symtoms you mention we are inclined to the opinion that your blast pressure is too high and your iron charges are too large. A pressure of 5 ounces is sufficient for a small cupola. Leave the coke as it is but reduce iron to 500 pounds.

Large Ingot Mold Weighs 191 Tons

AN EXTRAORDINARILY large ingot mold recently has been completed and placed into service at the plant of the Bethlehem Steel Co., Bethlehem, Pa. Ingots, will be cast in this mold, which will be used in making large forgings.

This casting weighed 387,590 *pounds as poured and the finished weight after cleaning and removing the sinkhead is* 382,000 *pounds or* 191 *tons. The casting is* 15½ *feet long,* 108 *inches wide measured across the corrugations at the top of the mold and* 97 *inches wide across the concave portions of the corrugations. The corrugated ingot and the sinkhead produced in this mold will weigh* 247 *tons.*

The ingot mold was cast in the pit shown in the accompanying illustration. The metal was poured from three ladles placed approximately 90 *degrees apart and connected by runways to the mold. The first ladle was poured through a gate entering the mold near the bottom. A few minutes later the remaining two ladles were opened. These were poured through a row of top gates, the metal dropping into the metal pool already formed at the bottom of the mold. The entire pouring operation was accomplished in* 14 *minutes.*



Special Manganese Steels *Show* Good Physical Characteristics

By John Howe Hall

FOR many years, manganese as an alloying element in cast steel has been known chiefly from the extensive use of the 12 per cent alloy discovered by the Hadfields in the early 1880's, which has found a wide field of usefulness as a wear-resisting steel. However, the original discoverers reported that manganese in amounts below about 7 per cent made steel exceedingly brittle, and these findings, coupled with the experience of the early makers of Bessemer rail steel, caused a ban to be placed on steels containing from a little over 1 to 9 or 10 per cent manganese, the lower limit of the useful range of wear-resisting steels. As a result, the adoption of moderate amounts of manganese as alloy addition to steel hardly was considered for many years.

In 1906, Leon Guillet, the eminent French metallurgist, published his *Industrial Study of Metallic Alloys*, including the results of a systematic study of the alloys of iron, carbon, and manganese. These results are summarized diagrammatically in Fig. 1, the well known diagram of the constitution of the iron-manganese alloys. Mr. Guillet was one of the first to call attention to the possibilities of moderate amounts of manganese as alloying additions in steel.

According to this diagram, all steels above the line connecting the points 14 per cent manganese and 1.65 per cent carbon consist of austenite. Mr. Guillet did not take account of the presence of cementite in the austenitic steels containing over 1 per cent carbon, and the lines *X Y* and *W Z* have been added to the diagram as the result of a research made in 1906 by H. M. Howe, William Campbell, and the author. Steels whose composition lies between these lines consist of pure austenite when quenched from temperatures above about 1000 degrees Cent. With carbon above the line *W Z*, whose equation is,

$$C = 1.075 + \frac{0.1\ Mn}{3},$$

free cementite will be found in the steels even after quenching. With carbon below the line *X Y*, whose equation is, C=1.075—0.04 Mn., the steels contain both austenite and martensite after quenching. Thus the limits of the range of composition of useful austenitic manganese steel are narrower than Guillet's diagram would lead one to expect.

Martensitic manganese steels yet have not found any industrial use, as far as the author is aware, on account of their great brittleness; but in the portion of Guillet's diagram marked pearlite, lies a range of possible compositions of great promise, in which active exploration is being carried on by a number of investigators.

Steels containing from 0.30 to 0.50 per cent carbon and from 2 to 3 per cent manganese, lying as they do close to the martensitic range, are pearlitic and comparatively tough in the annealed condition. However, they may be rendered martensitic and exceedingly hard by a simple air cooling from about 900 degrees Cent., and therefore should be useful for the manufacture of parts difficult to harden in water without cracking. The physical properties that have been obtained from cast steels in this range of composition, are shown in Table I.

However, the most widely used of the lower manganese steels contain 1 to 2 per cent manganese, and carbon from about 0.20 to about 0.50 per cent. The Taylor-Wharton Iron & Steel Co., High Bridge, N. J., with which the author is connected, pioneered the investigation of cast steels of this composition, and in 1909 developed a heat treated cast steel containing from 0.20 to 0.30 per cent carbon and from 1 to 2 per cent manganese, which had a remarkable combination of strength and toughness that made it an almost unique material at the time of its introduction. It has been produced since under a variety of trade names, and is being used to an increasing extent for service requiring castings of great

SEVERE service encountered in machine parts demands castings of unusual strength, and for this purpose special manganese steels have been found extremely useful. This article presents results of some recent tests on steel containing from 1 to 2 per cent manganese and is abstracted from a paper presented at the Detroit convention of the American Foundrymen's association held from Sept. 27 to Oct. 1, 1926.

John Howe Hall was born at South Portmouth, R. I., on June 20, 1881. He was graduated from Harvard university, Cambridge, Mass., in 1899 and received his master of arts degree in 1904. From 1904 to 1906 he was connected with the Bethlehem Steel Co., and eventually became assistant superintendent of the crucible steel department. He was steel melter for the Buffalo Crucible Casting Co. from June to October 1906 and left this firm to become metallurgist for the Taylor Wharton Iron & Steel Co., where he remained until 1913. During 1913-1914 Mr. Hall was engaged in consulting engineering at New York, and from 1914 to 1915 he was engineer of tests for the Quigley Furnace & Foundry Co. Since 1915 he has been metallurgical engineer for the Taylor Wharton Iron & Steel Co.

John H. Hall

Mr. Hall has made many improvements in the manufacture and heat treatment of manganese steel and of carbon steel for severe requirments. He is author of *The Steel Foundry*, a co-author of the *A B C of Iron and Steel* and has contributed many articles to the technical press. He is a member of the American Foundrymen's and other associations.

Table I

Tests on Special Manganese Steel

C.	Si.	Mn.	Heat Treatment*	Tensile Strength	Elastic Limit	Per Cent Elongation in 2 Inches	Per Cent Reduction of Area	Bend
0.36	0.24	2.42	{1,650—4—AC} {1,250—6—AC}	106,450 106,600	54,080 52,900	14.03 13.68	19.45 18.30	45 50
0.36	0.24	2.42	{1,650—3—AC} {1,220—6—SC}	97,700 97,950	68,800 70,200	12.00 17.07	20.10 28.09	75 70
0.32	0.19	2.38	{1,650—3—AC} {1,250—6—AC}	103,400	59,350	18.20	29.20	..

*Key to heat treatment: First group of figures represent temperature in degrees Fahrenheit; second group represent hours held at temperature. SC—slowly cooled; AC—cooled in air.

strength coupled with toughness.

The author has published data on the physical properties of this steel on numerous occasions, and feels that to extend the record here would be a superfluous task. However, during the past year research upon the elastic properties, shock toughness and endurance strength of this steel has been carried on in our laboratories, and it was thought that the results of these investigations to date would prove of interest at this time.

Shows Diagrams

In Fig. 2 are shown the stress-strain diagrams of eight specimens cut from coupons of this heat treated special manganese steel, tested, with an Olsen extensometer reading to 0.00006667 of an inch, the first six bars being tested in a gage length of 8 inches and the other two in 2 inches. The latter are plotted to such a scale as to be comparable with the other six specimens. It will readily be seen that the curves approximate closely to a straight line, so that the limit of proportionality is well marked, and the modulus of elasticity may be figured with considerable accuracy from the test data. Had more than one extensometer been attached, the curves no doubt would have been smoother.

Curves 9 to 12 are taken from an article by L. H. Fry in *Proceedings* A. S. T. M., 1922, the curves being redrawn to correspond with the scale on which the data on the special steel are plotted. The irregularity of the latter curves, which represent commercial cast steel, is at once apparent, and the impossibility of figuring a modulus of elasticity from these curves is evident. In his discussion of his results, Mr. Fry states, "The curve plotted from the whole body of tests lead to the belief that a tension specimen of cast steel stretches irregularly under a gradually increased load. This irregularity******is due largely to the nature of the material,******. Precise measurement and plotting of the stress-strain curve fails to determine a true elastic limit for cast steel." A study of Mr. Fry's results, and of the properties of heat treated cast steel such as is shown in curves 1 to 8 Fig. 2, has served only to deepen the author's conviction that for all service where it is desirable to have a material capable of resisting repeated heavy stresses, heat treatment of cast steel is absolutely essential, and *old fashioned* annealing is hopelessly out of date. If commercial cast steel has no true elastic limit, and no modulus of elasticity that can be determined by careful tests, it is surely a difficult problem to esimate the stresses that it can bear, safely. The only way to figure on it is to allow a generous factor of safety, or in other words, use a far heavier piece than really is necessary. By carefully controlled heat treatment, on the other hand, this uncertainty is done away with and cast steel placed in the class of materials whose behavior in service may be estimated with reasonable accuracy.

Shock Toughness

Tables II and III were compiled from recent test data to show the relative shock toughness of the heat treated special steel and commercial carbon cast steels of various carbon contents. These tests were made on specimens cut from cast coupons, in a machine of the Charpy design made by Tinius Olsen of Philadephia, of 30 kilagrams capacity. In all but one case, the average of two readings is given.

Table II shows clearly the relatively low resistence to impact or ordinary cast steels with a plain anneal, and the somewhat higher shock toughness that can be obtained by special heat treatment. It is also apparent from an inspection of Table III, and certain of the figures in Table IV, that the high manganese steel, which has been given a plain annealing, offers a relatively low resistance to impact. This fact is further shown by a comparison of the companion tests of heats 3676, 3663, 3685, 3688,

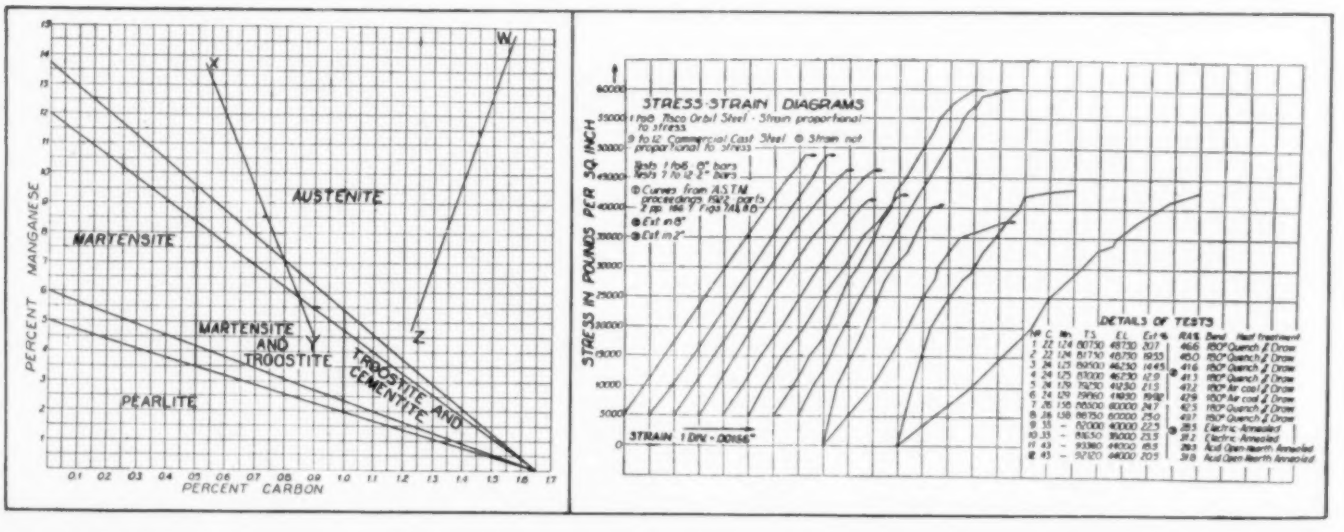


FIG. 1 LEFT—MODIFIED GUILLET DIAGRAM GIVING SUMMARY OF CONSTITUTION OF IRON-MANGANESE ALLOYS. FIG. 2 RIGHT STRESS-STRAIN DIAGRAMS OF SPECIAL STEELS AND COMMERCIAL CAST STEELS

and 3662, made on pairs of coupons, one of which received a plain annealing, the other a heat treatment. In every case, the extension, reduction of area, and angle of bend of the heat treated specimens is considerably higher than of those given a plain anneal. It is unfortunate that Charpy figures for the heat treated specimens are not avaliable.

When heat treated by *normalizing and drawing back*, the high manganese

Table II

Physical Characteristics of Carbon Steels

Test No.	Heat	C.	Si.	Mn.	S.	P.	Heat Treatment*	Tensile Strength	Elastic Limit	Per Cent Elongation in 2 Inches	Per Cent Reduction of Area	Bend	Charpy Kgm.	Charpy Ft. Lbs.
4014	C4014	0.14	0.22	0.64	0.047	0.045	1,650—4—SC	60,250	33,500	37.0	59.4	180	2.498	18.06
2441	C4344	0.18	....	0.73	0.067	.....	1,650—4—SC	67,000	38,250	31.0	49.2	180	1.580	11.42
2440	C4333	0.21	0.31	0.67	0.071	0.046	1,650—4—SC	68,500	41,250	32.5	48.6	180	1.580	11.42
2044	C3940	0.20	0.29	0.73	0.045	0.044	1,650—4—AC 1,250—6—AC 1,650—4—AC	69,000	41,500	34.5	58.6	180	2.809	20.30
3726	C3726	0.20	0.25	0.79	0.052	0.052	1,250—6—AC 1,650—4—AC	67,500	38,000	35.0	60.6	...	2.991	21.62
3940	C3940	0.20	0.29	0.73	0.045	0.044	1,250—6—AC	69,000	41,500	34.5	58.6	180	2.565	18.56
605	E2213	0.24	0.24	0.67	0.058	0.048	1,550—4—SC	64,750	40,500	22.5	25.2	70	1.016	7.34
604	E2212	0.26	0.21	0.63	0.046	0.043	1,550—4—SC	73,000	42,000	26.0	34.7	110	1.362	9.86
2438	C4285	0.27	....	0.75	0.072	.....	1,650—4—SC	74,250	43,500	13.5	14.8	40	0.758	5.48
3777	C3777	0.28	0.30	0.73	0.054	0.039	1,650—4—SC	76,000	39,000	27.0	41.3	175	1.220	8.83
602	E2203	0.30	0.26	0.83	0.052	0.045	1,650—4—SC	75,750	48,250	20.0	21.7	70	1.083	7.84
4103	C4103	0.32	0.39	0.78	0.049	0.046	1,650—4—SC	77,500	45,000	17.0	19.5	50	0.949	6.85
3[illegible]01	C3[illegible]01	0.32	0.34	0.73	0.048	0.041	1,650—4—SC	79,500	43,750	20.0	20.6	..	0.885	6.40
1661	E2522	0.33	0.21	0.88	0.054	0.040	1,650—4—SC	78,500	41,000	22.0	28.2	50	0.949	6.85
2324	C4103	0.32	0.39	0.78	0.049	0.046	1,550—4—AC 1,250—6—AC	71,000	47,500	16.0	16.7	50	0.949	6.85
2571	E2571	0.37	0.24	0.87	0.038	0.038	1,650—4—SC	81,500	44,250	18.0	25.2	60	1.155	8.00
2389	E2610	0.40	0.25	0.54	0.052	0.041	1,650—4—SC	79,000	38,250	20.0	24.4	65	0.8206	5.43
1693	E2528	0.42	0.19	0.79	0.056	0.035	1,650—4—SC	81,250	42,250	15.5	19.9	45	0.889	6.42
2387	E2606	0.43	0.21	0.85	0.044	0.039	1,650—4—SC	82,500	41,000	16.5	19.5	60	0.4576	3.31
2263	E2595	0.43	0.26	0.90	0.041	0.036	1,650—4—SC	90,000	44,500	22.0	36.0	93	1.220	8.82
2388	E2608	0.45	0.21	0.84	0.042	0.040	1,650—4—AC 1,250—6—AC 1,550—4—AC	83,500	48,500	11.0	11.1	130	1.291	9.35
2328	E2604	0.47	0.27	0.88	0.050	0.044	1,250—6—AC	81,000	49,500	29.0	48.3	180	1.505	10.88
2569	E2569	0.57	0.35	0.99	0.045	0.037	1,650—4—SC	110,000	65,750	10.0	11.5	45	0.6391	4.62

*Key to heat treatment symbol: First group of figures indicates temperature in degrees Fahrenheit; second group of figures indicates hours held at temperature. SC—slowly cooled; AC—cooled in air; Q—quenched in water.

Table III

Test Data on High Manganese Steel

Test No.	Heat	C.	Si.	Mn.	S.	P.	Heat Treatment*	Tensile Strength	Elastic Limit	Per Cent Elongation in 2 Inches	Per Cent Reduction of Area	Bend	Charpy Kgm.	Charpy Ft. Lbs
.....	C3676	0.23	0.25	1.02	0.086	0.049	1,650—4—SC	74,750	40,000	24.5	36.9	140	0.949	6.86
.....	C3663	0.25	0.30	1.22	0.081	0.048	1,650—4—SC	78,000	42,000	25.0	36.9	80	0.346	2.50
.....	C3685	0.22	0.28	1.24	0.089	0.046	1,650—4—SC	78,500	40,750	27.2	41.6	135	0.5162	3.73
.....	C3680	0.25	0.26	1.29	0.079	0.045	1,650—4—SC	75,750	40,000	26.2	38.8	140	0.6477	4.68
.....	C3688	0.26	0.31	1.35	0.079	0.048	1,650—4—SC	80,500	42,500	24.0	36.9	145	0.5456	3.95
.....	C3662	0.21	0.27	1.36	0.080	0.052	1,650—4—SC	78,250	42,750	27.0	41.9	85	0.4576	3.31
2515	C4534	0.27	0.45	1.58	0.066	0.056	1,650—4—SC	90,500	51,000	25.0	42.5	180	0.5205	3.76
4097	C4097	0.27	0.32	1.66	0.071	0.044	1,650—4—SC	.....	.....	....	....	...	0.2391	1.73
.....	C3676	0.23	0.25	1.02	0.086	0.049	1,650—4—AC 1,250—6—AC 1,650—4—AC	69,250	39,250	29.5	47.5	180	....	.....
.....	C3663	0.25	0.30	1.22	0.081	0.048	1,250—6—AC 1,650—4—AC	75,750	42,000	31.0	49.2	180	....	.....
.....	C3685	0.22	0.28	1.24	0.089	0.046	1,250—6—AC 1,650—4—AC	73,000	42,000	30.0	47.8	180	....	.....
.....	C3680	0.25	0.26	1.29	0.079	0.045	1,250—6—AC 1,650—4—AC	70,750	38,000	30.0	47.2	180	....	.....
2439	C4327	0.27	0.25	1.30	0.076	0.051	1,250—6—AC 1,650—4—AC	80,250	45,250	27.0	41.0	175	1.151	8.32
1641	C3636	0.29	0.38	1.31	0.079	0.047	1,250—6—AC 1,650—4—AC	75,750	50,000	29.0	49.7	180	1.580	11.42
.....	C3688	0.26	0.31	1.35	0.079	0.048	1,250—6—AC 1,650—4—AC	75,000	40,750	30.0	49.2	180	....	.....
.....	C3662	0.21	0.27	1.36	0.080	0.052	1,250—6—AC 1,650—4—AC	74,250	41,000	30.0	45.4	180	....	.....
3881	C3881	0.26	0.31	1.36	0.076	0.045	1,250—6—AC 1,650—4—AC	80,750	41,500	28.5	45.7	180	1.580	11.42
2042	C3[illegible]02	0.26	0.32	1.48	0.072	0.044	1,250—6—AC 1,650—4—AC	86,250	47,500	27.5	47.8	180	1.505	10.88
2484	C4379	0.30	0.27	1.62	0.078	0.047	1,250—6—AC 1,650—4—AC	91,000	48,500	25.5	44.9	180	1.658	11.98
4097	C4097	0.27	0.32	1.66	0.071	0.044	1,250—6—AC 1,650—4—Q	.....	.....	....	....	...	1.966	14.20
.....	C94154	0.24	0.32	1.14	.....	.....	1,200—6—AC 1,650—4—Q	86,750	56,750	26.4	61.8	180	2.300	16.65
.....	C95050	0.31	0.31	1.47	.....	.....	1,200—6—AC 1,650—4—Q	85,000	51,750	24.3	55.7	180	3.360	24.30
.....	C94215	0.25	0.40	1.50	.....	.....	1,200—6—AC 1,650—4—Q	87,700	64,150	27.0	59.2	180	2.995	21.60
.....	C94142	0.31	0.46	1.53	.....	.....	1,200—6—AC 1,650—4—Q	97,500	74,250	20.7	37.9	80	1.811	13.07
2493	C4438	0.30	0.33	1.53	0.078	0.046	1,200—6—AC 1,650—4—Q	92,000	57,250	27.5	46.3	180	2.564	18.53
.....	C94186	0.27	0.39	1.63	.....	.....	1,200—6—AC 1,650—4—Q	98,250	77,500	22.3	48.3	180	2.292	16.60
.....	C95038	0.33	0.49	1.80	.....	.....	1,200—6—AC 1,650—4—Q	119,700	84,885	17.4	26.3	70	2.345	16.98
.....	C94298	0.30	0.54	1.81	.....	.....	1,200—6—AC	95,800	75,000	22.2	43.8	70	2.498	20.35

*Key to heat treatment symbols: First group of figures indicates temperature in degrees Fahrenheit; second group of figures indicates hours held at temperature. SC—slowly cooled; AC—cooled in air; Q—quenched in water.

Table IV

High Manganese and Vanadium Cast Steel Compared

Heat	C.	Mn.	Va.	Heat Treatment*	Tensile Strength	Elastic Limit	Per Cent Elongation in 2 inches	Per Cent Reduction of Area	Bend	Charpy Kgm.	Charpy Ft. Lbs.
C3702	0.32	0.90	....	1650—4—Q	89,250	58,750	18.9	24.8	70	1.505	10.88
				1200—6—AC	86,500	52,500	22.1	28.5	65		
C3702 V	0.34	0.85	0.25	1650—4—Q	90,750	67,500	16.95	28.2	65	1.505	10.88
				1200—6—AC	89,000	70,000	18.0	25.5	60		
C3702	0.32	0.90	....	1650—4—SC	79,500	41,750	23.25	31.5	70	0.6391	4.63
				1650—4—SC	79,750	42,000	22.25	26.2	65		
C3702 V	0.34	0.85	0.25	1650—4—SC	89,750	55,750	16.5	19.9	42	0.8206	5.43
				1650—4—SC	89,750	53,750	16.9	19.9	45		
C3701	0.27	1.35	....	1650—4—Q	95,250	59,000	28.0	46.3	160	2.631	19.05
				1200—6—AC	95,500	60,000	28.0	47.8	95		
C3701 V	0.28	1.36	0.18	1650—4—Q	103,000	75,500	22.25	42.2	80	2.720	19.8
				1200—6—AC	100,250	76,750	12.0	24.4‡	85		
C3701	0.27	1.35	....	1650—4—SC	82,000	44,500	25.35	38.8	170	0.345	2.50
				1650—4—SC	81,750	44,250	24.5	39.1	145		
C3701 V	0.28	1.36	0.18	1650—4—SC	92,750	57,750	20.45	33.5	85	0.8206	5.43
				1650—4—SC	92,580	58,365	20.5	29.3	85		
C3743	0.30	1.47†	....	1650—4—Q	101,750	81,250	19.9	51.7	170	....	....
				1100—6—AC	102,250	82,750	19.6	52.2	140		

*Key to heat treatment symbols: First group of figures indicate temperature in degrees Fahrenheit; second group of figures gives hours held at temperature. SC—slowly cooled; AC—cooled in air; Q—quenched in water.
†Si. 0.29 per cent; S. 0.05 per cent; P. 0.051 per cent.
‡Flawed bar.

steel gives a comparatively high shock test, higher on the average than that of any of the ordinary cast steels shown in Table II except the low carbon steels. After quenching and drawing back, the high manganese steel averages higher in shock resisting value than any of the ordinary cast steels, including the dead soft material with carbon from 0.14 to 0.20 per cent. It is of interest to compare the average *yield point* of the heat treated special steel with the average *tensile strength* of the 0.14 to 0.20 per cent carbon material, in view of the fact that both steels give about the same Charpy impact value. The comparison is as follows:

0.14 to 0.20 Per Cent Carbon Steel	
Average tensile strength 66,840	Average Charpy foot pounds 16.89
Heat Treated Special Steel	
Average elastic limit 67,690	Average Charpy foot pounds 18.51

It is evident from this comparison that the high tensile strength and elastic limit of the special steel are not obtained at the expense of ductility and shock resisting qualities, as would be the case were the high strength secured by increasing the carbon, but are occompanied by an increase of toughness in both static and dynamic tests.

The tests in Table IV were made on two heats of steel, one of 0.32 per cent carbon and one of special manganese, to ascertain the relative effect of high manganese and of vanadium in cast steels. From each heat about 500 pounds of metal was poured into a bull ladle, the proper amount of ferrovanadium being thrown in while the bull ladle was being filled. A second bull ladle was then filled with metal to which no vanadium was added, and coupons were poured from the two ladles at as nearly as possible the same temperature. The bars cut from the coupons were treated side by side in an electrically heated laboratory muffle furnace, care being taken that the steel with and without vanadium was subjected to exactly the same conditions. All variables except same vanadium were thus eliminated as far as possible. Two bars from each coupon were tested.

Vanadium and Manganese

An inspection of the table shows that in every case the vanadium raised the yield point and the tensile strength of the steel to a considerable extent. The extension, reduction of area, and bend were decreased by the vanadium in almost every case, though the Charpy impact value is, if anything, slightly raised by the vanadium addition. The high manganese steel with a plain annealing gives a better tensile test and bend than the carbon-vanadium steel in the same condition, though a lower Charpy value. When quenched and drawn back, the high manganese steel gives nearly four times the shock tough-

Table V

Comparative Tests on Nickel Bearing Steels

NICKEL-CHROME STEELS

Test No.	Heat	C.	Si.	Mn.	S.	P.	Ni.	Cr.	Heat Treatment*	Tensile Strength	Elastic Limit	Per Cent Elongation	Per Cent Reduction of Area	Charpy Kgm.	Charpy Ft. Lbs.
2327	C4251	0.51	0.39	0.71	0.051	0.045	2.85	0.87	1,550—4—AC 1,250—6—SC	108,000	72,000	17.5	24.8	1.083	7.85
2326	C4226	0.54	0.35	0.77	0.049	0.044	2.97	0.88	1,550—4—AC 1,250—6—SC	128,000	80,750	12.5	11.5	0.758	5.48
2325	C4218	0.60	0.33	0.67	0.04	0.041	2.81	0.92	1,550—4—AC 1,250—6—SC	116,000	80,000	15.0	21.7	1.22	8.82

FORGED NICKEL STEEL

C.	Si.	Mn.	S.	P.	Ni.	Heat Treatment*	Tensile Strength	Elastic Limit	Per Cent Elongation in 2 inches	Per Cent Reduction of Area	Bend	Charpy Kgm.	Charpy Ft. Lbs.
0.35	0.16	0.50	0.019	0.012	2.96	Oil Q. and draw	86,500	53,500	27.2	52.5	180	2.809	20.35

*See Table I for heat treatment symbol key.

ness of the carbon-vanadium steel plain annealed, with better tensile figures and bends. Even when quenched and drawn back, the carbon-vanadium steel gives but half the shock toughness of the high manganese steel in the same condition, and not as high extension, reduction of area and bend. It also is worth noting that the Charpy value for the carbon-vanadium steel with a plain anneal is not as high as that of the plain carbon steels of equivalent carbon shown in Table II. The last test in Table IV was made on a coupon from another heat of the special steel, heat treated to give a high elastic limit. No Charpy test was made on this coupon, but the results in the last two lines of Table III indicate that this high elastic limit may be obtained with but little sacrifice of impact strength.

It would appear from these figures that the increase of elastic limit and tensile strength due to vanadium is accompanied by a considerable decrease in the toughness of the steel, whereas the increased strength obtained by additions of manganese coupled with suitable heat treatment is accompanied by a great gain in ductility and shock strength. In considering these figures, it should be remembered with all variables except vanadium were eliminated by the method of procedure adopted.

Table V is included to show the relatively low toughness and shock strength of high carbon cast nickel-chrome steel; and that the Charpy value obtained a heat treated forged nickel steel is about the same as that of the heat treated cast special manganese steel.

Endurance Tests Made

In Table VI and Figs. 3 and 4 are given the results to date of endurance tests made in a Farmer type machine as modified by the University of Illinois engineering experiment station. For these tests, six bars cut from three coupons of each type of steel were subjected to various loads, the tests being continued in each case at a constant load until the bar broke, or until it had withstood at least 10,000,000 alternations of stress. Certain of the test bars afterwards were put back into the machine and run at the same load, either to failure or until they had withstood 20,000,000 revolutions.

Endurance limit of the special steel in the *annealed* and the *air-cooled and drawn* conditions is from 42,000 to 43,000 pounds per square inch; in the *quenched and drawn* condition, about 46,500 pounds per square inch. Plain annealed cast steel of 0.37 per cent carbon gives an endurance limit of about 37,000 pounds per square inch; similar steel of 0.33 per cent carbon about 34,000 pounds per square inch, and of 0.28 per cent carbon about 33,000 pounds per square inch. Although the program of endurance tests is yet far from completed, it is felt that already sufficient data have been accumulated to justify the inference that the special steel has a considerably higher endurance limit than ordinary cast steels of much lower strength and toughness. The author feels that the results of these tests fully justify the opinion he long has held that heat treated cast steels containing from 0.20 to 0.30 per cent carbon, and manganese from 1 to 2 per cent, possess a remarkable combination of properties that makes them of the greatest value for severe service in machine parts. Indeed, the tests are but a confirmation and explanation of the remarkable record made by castings of this class which have been manufactured during the 17 years since they first were introduced.

Table VI

Endurance Tests on Special Steels

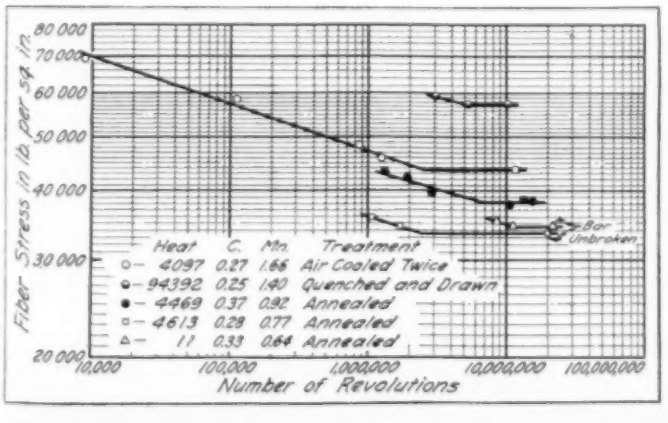
Heat No.	C	Si	Mn	S	P	Heat treatment†	Fiber stress	Revolutions 1st run	Revolutions 1st and 2nd run
C 4097	0.27	0.32	1.66	0.071	0.044	1650-4-SC	55,835	182,800	
							45,380	1,352,000	
							45,325	1,801,300	
							44,259	16,064,000*	16,358,600
							42,735	10,532,000*	18,714,100
C 4097	0.27	0.32	1.66	0.071	0.044	1650-4-AC	68,389	8,900	
						1250-6-AC	58,483	101,300	
							48,431	855,900	
							45,805	1,245,300	
							43,677	11,837,100*	14,598,400
C 94,392	0.25	0.37	1.40			1650-4-AC	44,767	3,220,900	
						1250-6-AC	43,920	10,074,000*	11,640,200
							43,543	13,486,900*	21,433,300*

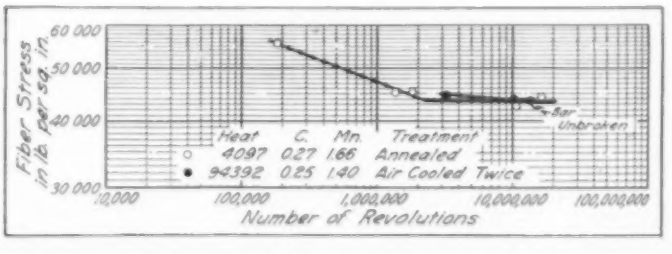
*Unbroken.
†For key to heat treatment symbols see table I.

Offer Assistantships

To assist in the conduct of engineering research, the university of Illinois, Urbana, Ill., maintains 14 research graduate assistantships in the engineering experiment station. These assistantships carry an annual stipend of $600 with freedom from all fees except matriculation and diploma fees, and are open to graduates of approved American and foreign universities and technical schools. Research work and graduate study may be undertaken in architecture, architectural engineering, ceramic engineering, chemistry, civil, electrical, mechanical, mining, municipal and sanitary engineering. Applications should be sent to M. S. Ketchum, director, engineering experiment station, University of Illinios, Urbana, Ill., by April 1.

Pittsburgh office of the Hyatt Roller Bearing Co., now is located at 806 Fulton building.





FIGS. 3 AND 4—ENDURANCE TESTS OF SPECIAL MANGANESE AND COMMERCIAL CAST STEEL OBTAINED ON THE MODIFIED FARMER MACHINE

How to Make a Mold
FOR A LONG HOLLOW CYLINDER

Several Alternative Methods Suggested—Local Conditions Affect Final Choice—Loam and Dry Sand Compared As a Molding Medium

SEVERAL methods usually suggest themselves when a new job is taken in the foundry, particularly when the job presents features out of the ordinary either in shape or size or the number required in a given time. The total volume also exerts a bearing on the amount that safely may be invested in new equipment. Recently one of our British friends was confronted with the problem of supplying a large number of cast iron cylinders, 3 feet diameter, 9 feet in length, 1⅝-inch metal thickness and with a 4-inch internal flange supported with brackets at each end. The order called for a production of six a day. With a view of checking up on his own practice, he inquired how this casting would be made in America.

Many methods are available and practiced for molding castings similar in a general way to the cylinder which formed the subject of the inquiry. To say which is best is rather a difficult problem without a knowledge of the equipment on hand. It is readily apparent that if equipment already is in existence by which the castings may be molded in a certain manner, the foundryman would be ill advised to make an entirely new set, however, excellent, unless the time saved by the new set more than compensated for the cost.

However, assuming that the field is absolutely clear and that an entire new set of rigging must be built for the job, then without doubt the method practiced in some of our southern foundries for making cotton packing cylinders is the best to our knowledge. These molds are made in dry sand and will be described first. The foundryman equipped for making loam molds may find it advisable to make the outer part of the mold in loam, but the method of making the core may be applied either to a dry sand mold or a loam mold. One advantage of the loam mold is that with a slight amount of patching each time it is used it will serve for a great number of castings.

Rigging required for the sand mold includes eight flask sections for the outside. One shallow drag, six sections each 16 inches deep and one combined cope and runner basin 9 inches deep. Each of these sections is 3 feet 6 inches diameter inside to provide a 3-inch thickness of sand between the casting and the wall of the flask. A somewhat similar set of flasks is provided to form the core arbor and inside wall of the mold. In the steam cylinder referred to, one of the end flanges is on the outside, therefore the core arbor is made to a size that will allow approximately 3 inches of sand. There is plenty of clearance to remove the arbor from the casting. In the casting shown in the accompanying illustration, both end flanges are on the inside, therefore a choice is presented in the style of arbor. Either one piece rings not over 22 inches outside diameter must be used, or split rings up to 27 inches diameter may be employed in the space between the upper and lower flange.

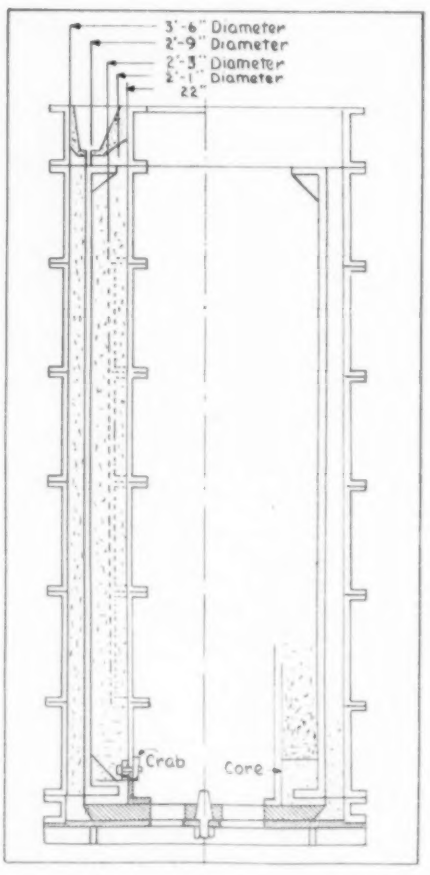


FIG. 1—FLASK AND CORE EQUIPMENT FOR LONG CYLINDER. DOTTED LINES TO THE LEFT SHOW A LARGER ARBOR IN WHICH THE RINGS ARE SPLIT IN TWO FOR REMOVAL FROM THE CASTING

One piece rings are most convenient to handle in making the core and later in stripping the core from the casting. Split rings reduce the amount of sand required in the core and in that manner save time both in making the core and in drying it. Flask sections for the outside of the mold and rings for the inside of the core are pierced liberally with vent holes. This type of casting is one in which the gas must escape readily, otherwise it will cause the metal to boil more or less and create dirty and porous areas.

Other pieces of rigging include a lifting plate for the core and either one or two crabs, depending on whether the core is made in one or two sections. A one piece core is preferable, but sometimes a high core must be cut in two on account of oven or crane conditions. The crab is made in two parts so that it may be removed from the casting. Key pins instead of bolts are employed to fasten the crab to the face of the core arbor. The keys and pins are easily knocked out and they do not jam, strip, or get rusty like the thread on a bolt. A tapered hole accurately drilled in the center of the lifting plate locates the plate over a tapered pin bolted to the center of the bottom plate. A shoulder turned near the perimeter of the bottom plate guides the drag into place in a similar manner. The flasks are faced on the joints and the lifting plate is turned on the rim.

From the foregoing it is apparent that a considerable amount of machine work is required on the flask and arbor equipment. However, the expense is soon absorbed in the time saved in assembling the various parts. Also the chance of error on account of the human element in the equation is eliminated. All the parts are concentric, measured from a common center, therefore a uniform thickness of metal is assured in the casting. If necessary the assembling of the mold and core may be left in the hands of men with little experience.

Pattern equipment for making the mold includes an internal flange with

brackets attached, for the top and bottom; also a cast iron ring approximately 3 feet high and corresponding to a section of the required casting with the necessary contraction allowance. This ring is drawn up by successive stages as the ramming progresses until the top is flush with the top of the assembled flask and core arbor. For a production of six castings a day, six patterns will be required. The number of men required will vary depending on the locality and to some extent on the extent of the mechanical equipment available. In any event it is well to bear in mind that a minimum number of men with maximum pattern equipment is cheaper than a maximum number of men working mith minimum pattern equipment. Two men with single patterns will get along further than three men trying to crowd around a single pattern.

With this thought in mind it may be advisable to provide patterns and coreboxes so that the two parts of each mold may be prepared independently of each other and later assembled after they have been dried. A separate corebox is a necessity where the outside of the mold is swept in loam. This feature will be touched upon again. In the meantime we continue to assume that the mold is made by hand in a flask in dry sand.

Plates Are Located

At the beginning of the job the bottom plates are leveled carefully and are not disturbed again until the contract is finished. Where the castings are made over a long period it is advisable to anchor the plates on a concrete or any other suitable form of permanent foundation.

Reference to the accompanying sketch will illuminate the text in the following description of how one of the molds is made. The core lifting plate is located on the bottom plate followed by the drag flask and the first ring of the core arbor The parting line between the cheek and drag on the outside is made flush with the bottom of the flange on the casting, but it will be noted that the first ring of the core arbor extends above and below the flange on the inside to prevent the metal from bursting through at this point of greatest pressure. Sand is filled into the drag, around and over the part of the plate between the drag wall and the core arbor. The sand is rammed and then scraped off flush with the face of the drag flask. This level bed forms the lower face of the mold and also serves as a support for the lower flange and the ring pattern.

An alternative method is to first make a suitable seat for the lifting plate by ramming sand around a wood dummy plate. This method prevents the sand from tearing up around the rim when the core is lifted out of the seat. The same effect is secured in the first method by running the point of a trowel down to the rim of the plate and then following the rim all the way around. Other methods of forming the bottom flange in cores are shown in Fig. 2.

The wood flange to which the brackets are attached is cut to a diameter of 36 inches so that it may serve as a support for the heavy ring pattern. It is in several sections so that it may be removed readily before the core is placed in the oven. The corresponding flange on the top of the mold is cut to fit the inside diameter of the ring pattern. It is in one piece and is lifted straight up after the ring pattern has been removed.

The crab shown in the lower left corner Fig. 1 in two parts is attached to the lower section of the core arbor, with the prongs disposed to the best advantage among the brackets on the pattern. The remaining parts of the flask on the outside and the core arbor on the inside are built up and the sand between is rammed in the usual routine manner until the top is reached. If necessary a parting may be made half way up so that the mold and core may be removed in sections for convenience in handling and drying. If this course is necessary, a second crab is fastened to the arbor ring at the parting line and suitable lugs are provided on the arbor ring for attaching the slings, cam hooks or other lifting device.

Instead of ramming a cope on top of each mold, it is better to ram all six over a suitable runner basin block attached to a flat board. Twelve short runner sticks ½ x 1 inch equally spaced and one plug, 2 inches diameter, are attached to the narrow face of the block to form gate openings and a riser opening respectively. If a jolt machine is available the copes may be rammed on it in a minimum of time. The best type for the purpose is one in which the pattern may be drawn down before the cope is lifted; but with a generously drafted pattern any type may be employed to advantage. The cope in effect is nothing but a magnified runner basin with shallow bars across the bottom to carry the weight of iron in the runner and afterward resist the upper pressure from the top flange of the casting.

Suggests Alternate Methods

An alternative method of forming the lower flange is to assemble a ring of dry sand cores as shown at the lower right in Fig. 1. This core may be made all in one piece from a full corebox or made in a number of segments from a smaller corebox. A short piece of 2-inch plank is placed under the overhanging part of the core and is left there until the core is dried. Then it is removed and replaced with a stud chaplet if conditions seem to warrant such support. Certain sands need more support than others.

Reference to the molding machine suggests another method of making the main core in, say, six sections; two sections, each with a flange and brackets for the top and bottom and four plain sections in between. The same corebox would serve for the entire set by leaving the flange and brackets loose. After the top and bottom cores are made the flange and

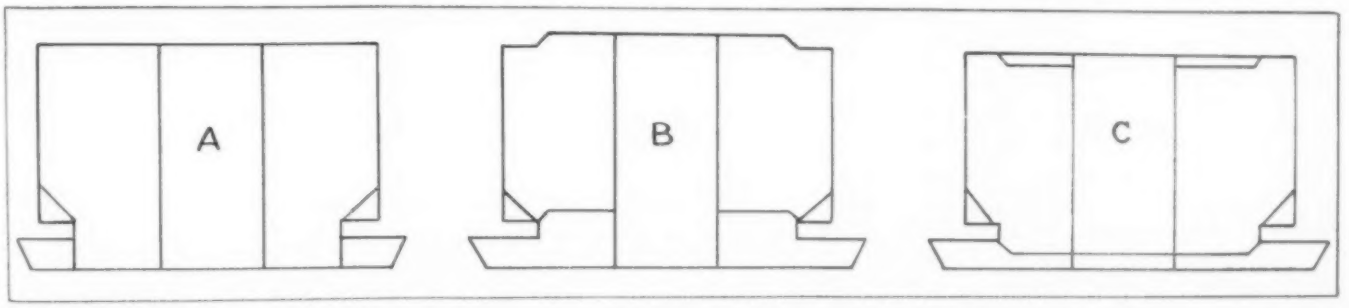


FIG. 2—THREE ALTERNATIVE METHODS FOR SETTING CORES TO FORM THE LOWER END AND THE INTERNAL FLANGE ON THE CYLINDER CASTING. THE REMAINDER OF THE CORES IN THE *A* SET ARE LINED UP WITH A STRAIGHTEDGE. THE MALE AND FEMALE JOINTS ON THE *B* AND *C* SETS LOCATE THE SECTIONS IN PLACE

brackets are removed from the box and a circular slab is dropped into the 25-inch diameter cavity designed to form the print on the bottom section. A shallower slab is used in the box for the top core since the core is designed to finish flush with the cheek and furnish a rest for the under face of the cope. The core-box is split vertically.

This style of core might be used with any type of vertical mold, but is particularly adaptable for use with a loam mold. The various sections may be assembled on top of each other and the joints daubed before the cheek is lowered over them. Plain cast iron arbors made in open sand molds will serve in these cores. They may be broken out easily after the casting is poured. The cost practically is negligible, since the iron is recovered and a man can make a set of arbors in half an hour.

Disciples of bottom pouring may indulge their hobby by providing a drag with a side pocket to contain the gate. Modern foundry practice does not regard the method with favor. It entails far more work than the top method. It is far more dangerous since it exerts a tremendous pressure at a point in the mold where a runout would be fatal. It is in direct contradiction to the natural laws of gravity and contraction. Theoretically, but a theory that is borne out by practical application—a casting should begin cooling at the bottom so that the hotter iron on the top should have a chance through the law of gravity of compensating for the natural contraction. Where a casting is poured at the bottom, the hottest iron is at the bottom when pouring ceases.

A ring of pop gates on the top insures clean iron in the mold. Fresh iron entering at a dozen points brings the wall of the casting up uniformly and prevents cold shuts either visible or invisible. The iron commences to set first in the bottom flange and in that manner relaxes some of the strain against the wall of the mold. In a top poured mold the bottom flange practically is solid before the metal attains maximum height in the mold. Segregation and *draws* inevitable under the upper flange in a bottom poured mold, unless the flange has been fed with several large risers, will not be found in a top poured casting. This refers only to shrinkage. The method of pouring has no connection with leaky sections at the junction of the flange and body caused by steam or gas from the core. Particular attention must be paid to the upper part of the core under the flange. It must be vented freely to prevent the least flutter when it is covered with iron.

If the extent of the contract warrants the expenditure or if mechanical sand handling equipment and molding machines already are in the foundry, then the entire set of flasks for the outside of the molds may be jolted on one machine while the cores are formed on another. A swinging spout from a suitable hopper will supply the sand to each installation.

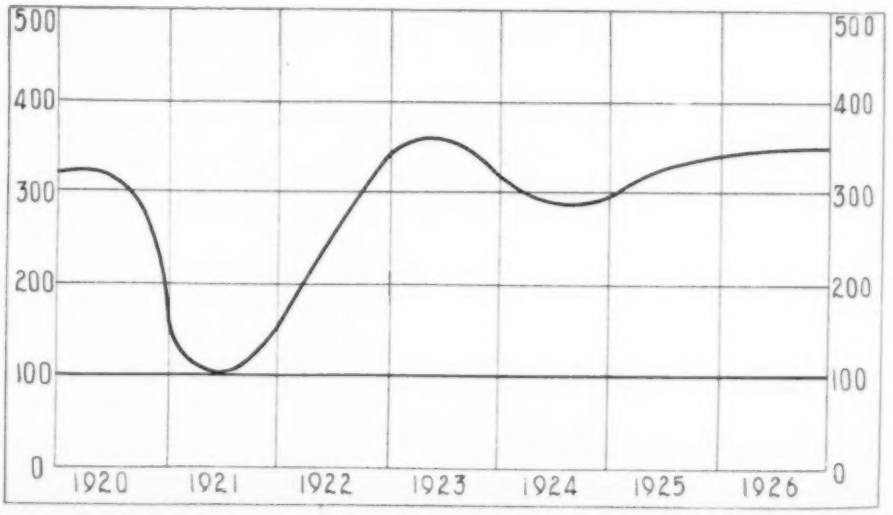
A comparatively small crew of men operating another type of machine in which the sand is thrown with great force and in a constant stream, would carry the molds and cores as far as the oven stage every day. Of course the assembling on the following day would have to be done by a separate crew.

Made Sales Manager

Ferdinand G. Schultz, Pittsburgh, has been appointed district sales manager, American Foundry Equipment Co., Mishawaka, Ind. in its western Pennsylvania territory, with headquarters in the Park building, Pittsburgh. For the past six years Mr. Schultz has been allied with the sand blasting and foundry industries in a sales capacity. He is widely known in the metal working industries of the East.

Shows Trend of Sales

A recently completed survey conducted by the Foundry Equipment Manufacturers' association indicates the trend in recent years toward mechanicalization of foundries. This report which covers a period from 1920 to 1926 gives a graphic presensation of foundry equipment sales for seven years. Using the average sales of 1921 as a basis, it shows conclusively a steady demand for all of the classes of machinery represented by membership in the association. The graph is presented in the accompanying illustration.



FOUNDRY EQUIPMENT SALES SHOW HIGH AVERAGE FOR SEVEN YEARS

Book Review

Patents: What a Business Executive Should Know About Patents, by Roger Sherman Hoar, 232 pages, cloth, 6 x 8½ inches, published by the Ronald Press Co., New York, and supplied by THE FOUNDRY, Cleveland, for $4.50 and in London, 2-3 Caxton House, Westminister S. W. 1, for 20/6.

The average man whether he occupies an executive position or otherwise knows comparatively little about patents. To many executives, the knowledge of patent procedure is vital because litigation is costly. Some error in or failure to consider patent claims properly may result in loss of valuable rights. While the book is rather heavy in places, the author has done his best in putting the facts in plain English. The mystery, obscure terminology and hocus-pocus that surround that highly specialized and technical field, patent law, are eliminated to show the business executive his place in the scheme. Chapters are devoted to the following: What Is a Patent; What Is Patentable; Anticipation and Domination; Who Is Entitled to a Patent; Infringement; Patent Office Procedure; Patent Office Tactics; Interferences; Protecting an Invention; Conflicting Rights; Choice of an Attorney; Legal Papers; Searches; Interpretation and Validity; Organizing a Patent Department; Contracts; Foreign Patents; Misconceptions Summarized.

A LEXICON OF TECHNICAL TERMS

(*Continued from Data Sheet No. 658*)

Limit of proportionality
Yield point
Endurance limit
Elongation
Reduction of area
Deflection (transverse)
Permanent set
Modulus of elasticity in compression
Modulus of elasticity in shear
Modulus of elasticity in tension
Modulus of torsion
Modulus of flexibility
Modulus of resilience
Modulus of rupture
Modulus of cubic compressibility
Volumetric modulus of elasticity
Specific tenacity
Elastic ratio
Patience
Poisson's ratio
Hardness
Machinability
Polishing qualities
Wearing properties

Terms pertaining to or describing properties of metals and alloys due to temperature variations. (Thermal properties).

Melting point
Freezing point (setting point)
Boiling point
Combustibility
Fusibility
Critical points
Hysteresis temperature
Annealing temperature
Recrystallization temperature
Calescent point
Latent heat of fusion
Specific heat
Linear coefficient of thermal expansion
Thermal conductivity
Thermal capacity
Thermoelastic properties
Blue heat phenomena
Blue shortness
Cold short
Red short
Contraction
Expansion
Polymorphic transformation point
Dilatation
Growth property
Breaking-down temperature
Red Hardness
Critical cooling velocity
Critical velocity of quench
Quenching temperature
Fluidity (life)

(*Continued on Data Sheet No. 660*)

A LEXICON OF TECHNICAL TERMS

(*Continued from Data Sheet No. 659*)

Terms pertaining to or describing electrical properties of metals and alloys.

Electrical conductivity
Specific resistance (resistivity)
B. H. maximum
Residual induction
Temperature coefficient of resistivity
Magnetic properties
Electrical permeability
Electrolytic potential
Coercive force
Flux density
Maximum induction
Remnant induction
Maximum permeability
Demagnetizing force
Electrolysis
Mitigation
Hysteresis
Energy dissipated per cycle

Terms pertaining to or describing general shop properties of cast alloys.

Alloy
Alloy cast iron
Blowy
Chill
Cold iron
Cold shut
Cold wild
Cracked
Dirty metal
Distorted
Leaky
Misrun
Oxidizing properties
Scab
Segregation
Shrinkage
Sponginess
Strained

Mineralogical terms applied to metals and alloys.

Color
Streak
Lustre
Fracture
Cleavage
Crystal structure
Grain structure

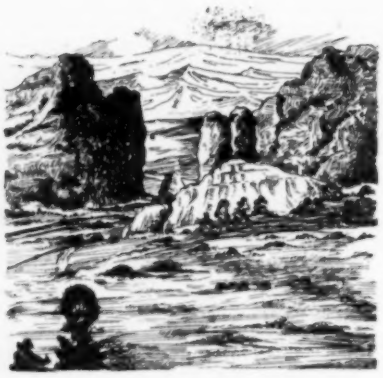
(*Continued on Data Sheet No. 661*)

THE FOUNDRY DATA SHEET, MARCH 1, 1927
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

Seeing America with The Foundry

Little Journeys to the homes of our readers



COLORADO has a total of 42 foundries of which

32 Melt Gray Iron
10 Nonferrous
4 Steel
16 Aluminum

COLORADO — the "Centennial State" is nearly twice as large as the combined area of the New England States and is larger than Great Britain. The present population is approximately 940,000 and so it is easy to assume that there are many "wide open spaces".

Mountain scenery and lofty mountain peaks, swift running rivers pouring their waters down from the melting snow of the many mountains and teeming with gamey fish and the forests abundant in large game such as deer, elk, grizzly, brown and black bears make this a wonderful vacation state.

The annual agricultural wealth amounts to $150,000,000. The variety of products is practically unlimited and the leading crops in order of money value are hay, wheat, corn, sugar beets, potatoes, beans, oats, barley, peaches, apples, broom corn and vegetable seeds.

Smelting and refining take the lead of all industries, but the state is further distinguished by the manufacture of iron and steel, tin and copper, stoves, car wheels, brick and pottery. An unlimited supply of coal, ores, all forms of building material and the possible supply of electric power by utilizing the mountain rivers all combine to insure a great future in the manufacturing industries of Colorado.

In COLORADO THE FOUNDRY has 32 paid subscribers

"Wherever metals are cast you'll find THE FOUNDRY"

Control Aluminum Temperature

Many Foundries Have Learned That Close Temperature Control Is Not Only Desirable but Actually Necessary for the Most Economical Production of High Quality Castings

By Kirtland Marsh

MELTING operation requires close temperature control if the best results are to be obtained, because the time during which the metal is in a molten condition is a critical period; long soaking periods at high temperatures tend to increase the gas content, oxidation and iron absorption of the metal. Molten aluminum absorbs gases and the rate of absorption and the amount absorbed increases rapidly with the temperature.

Oxidation of the metal is slight in any case and iron absorption can be fairly well controlled, even in iron melting pots, by proper cleaning and coating of the pots. The principal ill effect, therefore, of overheating and long soaking periods even at moderately high temperature is the gassing of the metal. To melt the metal and bring it up to the proper temperature for pouring as quickly as possible, without overheating, reliable pyrometric equipment must be used. If the temperature of the molten metal is known at all times, gas absorption can be minimized and no metal need be sent to the molds too cold.

By making sure that the metal was not soaked too long at high temperatures or overheated, considerable improvement in the quality of the castings would be assured and pyrometric equipment for that purpose alone would be well worth while. Accurate control of the pouring temperature is just as essential, and if such is not provided, many defective castings will be produced which otherwise might have been avoided.

Determine Temperature

Whenever a new pattern is received by a foundry, it must, of course, be inspected to determine if it is properly constructed to meet the particular practices employed in that foundry. After this has been done and the best method of gating decided, size of flask, etc., determined, the best pouring temperature should be determined by an actual test in the following manner: Make up several molds and pour them with metal at different temperatures varying by 20 degrees Fahr., starting with metal which is known to be hot enough to pour the casting and ending when the first miss-run appears. Note the lowest temperature at which the mold can be poured without a miss-run and designate a temperature 20 to 40 degrees Fahr. higher as the best pouring temperature for production pouring of that particular mold. The addition of the 20 or the 40 degrees is a factor of safety to allow for variation in the molds, rate of pouring, etc. If a lower pouring temperature is used occasional miss-runs may be encountered and if higher pouring temperatures are used, not only must the metal be heated to a higher temperature in the melting pots or furnaces, which means greater absorption of gases, but the castings may show shrinks, draws and cracks.

The avoidance of overheating of the metal during the melting operation and pouring at the correct temperature will help to eliminate many operating difficulties and defective castings, but proper temperature control should by no means be considered as a cure-all. Even correct pouring temperatures cannot fully control shrinks, draws, metal cracks and to some extent gas holes, for these defects are controlled principally by proper gating, application of chills, the correct speed and steadiness of pouring, slow feeding of risers, etc.

Gates and Risers Important

For example, consider the gating of a mold. The gates and risers should be so arranged as to provide for progressive feeding of the mold, for that will eliminate the shrinks and draws caused by the shrinkage of the aluminum which occurs as it passes from the molten to the solid state. A given weight of aluminum in the solid or frozen condition occupies considerably less space than when molten. With progressive feeding, those portions of the mold which are filled first will be fed, as the metal in these portions solidifies, by subsequently poured metal which will still be molten. The molten metal should fill the gates and risers last so that there will be molten metal available to feed those portions of the actual mold which were the last to be poured. Under such conditions there is always a supply of molten metal back of those portions which are freezing which will follow the shrinking metal and eliminate the formation of shrinks and draws. Even with proper gating to provide for progressive feeding, the occurrence of shrinks, draws and miss-runs is quite possible if the metal is not poured at the correct temperature. If the metal is poured too hot these defects are liable to be encountered and also blow holes caused by gas from the mold and cores will be more frequent. On the

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IN THIS the first of two papers on the subject of temperature control in aluminum foundries the author presents many reasons why good temperature control equipment should be employed and then describes available pyrometric equipment and methods for using it. Kirtland Marsh, author of these articles abstracted from a paper presented at the Detroit meeting of the American Foundrymen's association, is a native of West Newton, Mass., and was educated in the Newton public schools and the Worcester Polytechnic institute, receiving the degree of B. S. in mechanical engineering from the latter school in 1914.

From 1915 to 1917 he was in charge of installation and maintenance of pyrometric equipment at the Worcester, Mass. plant of the Norton Co. During the War Mr. Marsh served in the army, being in charge of recommendation, installation, and maintenance of pyrometric equipment in gas mask manufacturing plant operated by the Astoria detachment of the chemical warfare service. Since leaving the army in 1919 he has been chief of the pyrometric division, technical direction bureau of the Aluminum Co. of America, where he is in charge of the temperature control equipment and investigation for the determination of the operating characteristics of industrial furnaces of the several plants of this company maintained in different cities.

Kirtland Marsh

other hand, if the metal is poured too cold, miss-runs will result.

The temperature to which the metal must be heated in the melting pots or furnaces will depend upon the drop in temperature between the furnace and the mold and the highest metal temperature required for any one mold. If several small furnaces or pots are used in the melting room, these may be operated at several different temperatures to accommodate the different molds being poured, but if the metal for all molds is melted in one furnace, it must be hot enough to accommodate the highest pouring temperature being used. In the latter case, it will be necessary to allow the metal for some molds to cool either naturally or assisted by the use of chill bars or the addition of cold metal, and if close temperature control is to be assured, pyrometric equipment must be provided for taking the temperature of the metal in the pouring ladles, as well as in the melting furnaces. In a small foundry it would be possible to use one pyrometer for determining the temperature of the metal in the furnaces and also in the ladles, but it is generally better to have individual instruments for these two purposes.

Temperature control of the core ovens also is essential for the economic production of the best cores; the temperature at which they are baked and the rate at which they are brought up to that temperature has considerable effect on the quality of the cores. If cores are baked too hard, i. e., at too high a temperature, the casting is liable to crack as the metal freezes, because the strength of the core is greater than that of the hot metal. If they are underbaked, too much volatile matter is left in them which will volatilize when the hot metal strikes the core and the evolved gas will produce blow holes. Overbaking also may produce weak cores, because the binder is nearly all burned out, and such cores are liable to break in the mold and produce sand holes and inclusions.

Heat Treating of Castings

Some aluminum sand casting alloys show a considerable improvement in their physical properties when subjected to special heat treating processes. All heat treatment is done after the casting has been removed from the mold and close temperature control is absolutely essential if the best results are to be obtained. Furnaces fully equipped with automatic temperature controllers and designed so as to give uniform temperature distribution throughout the heating chamber are essential for these operations. The higher physical properties secured by heat treatment of castings poured from these alloys enables them to be used to great advantage where otherwise other materials would be required.

A thermoelectric pyrometer is the only practical instrument for measuring the temperature of molten aluminum, and for the benefit of those who are not thoroughly familiar with this instrument a brief description will be given.

Hot and Cold Junctions

A thermoelectric pyrometer consists essentially of a thermocouple, connecting leads and a voltage measuring instrument. The thermocouple consists of two elements, of different chemical composition, in the form of two wires or one wire and a surrounding tubular element. Generally, the two elements are welded together at one end to form a good electrical and mechanically strong junction, known as the hot junction. The other end of these elements, whether they are actually joined together or not, forms the cold junction. If there is a difference in temperature between the hot and cold junctions a voltage or electro-motive force (e. m. f.) will be generated in the two elements, the value of which depends upon the temperature—e. m. f. characteristics of the two elements, the temperature of the hot junction and the difference in temperature between the hot and cold junctions. If the cold junction temperature is kept constant then the voltage generated by any given couple bears a fixed relation to the temperature of the hot junction and any instrument designed to measure the small voltage generated can be graduated to read the temperature of the hot junction directly.

It is seldom practical to connect the measuring instrument directly to the ends of the thermocouple and therefore leads are used between the couple and the instrument. If copper leads are used, the cold junction of the couple is at the ends of the two thermoelements, but if the leads are of the same material as the thermocouple or have the same thermoelectric characteristics as the couple, over the temperature range to which they will be subjected, then the cold junction will be at the ends of these leads. It is common practice to use the latter type of leads between the couple and the instrument to remove the cold junction to a point of more constant temperature than generally exists at the ends of the thermocouple elements themselves.

The voltage measuring instrument may be a deflection instrument of the galvanometer type, like the common direct current voltmeter, a potentiometer or an instrument embodying the principles of both. No description of the construction of these several types of instruments or the principles upon which they operate will be given in this paper. For information on this phase of the subject, the reader is referred to technologic paper No. 170 of the bureau of standards entitled *Pyrometric Practice* by Foote, Fairchild and Harrison.

When the voltage measuring instrument is of the galvanometer type, the accuracy of the instrument depends upon the constancy of the external resistance, i. e., the resistance of the couple, load and connections. If the value of the external resistance changes, due to loose connections or any appreciable change in the length of the leads, then the reading of the instrument will be in error by an amount which is a function of the correct value of external and internal resistance and the change in external resistance. Therefore, all connections should be kept tight and the resistance of the leads should not be appreciably changed by lengthening or shortening them.

The Cold Junction

In any pyrometer installation due attention must be given to the cold junction of the thermocouples, for the accuracy of the installation depends upon a constant cold junction temperature being maintained or a varying cold junction temperature being compensated for. By the use of special lead wires having the same thermoelectric characteristics as the thermocouple, the cold junction may be moved from the end of the couple itself to a point of constant temperature or to the measuring instrument where some special device compensates for changes in the temperature of the actual cold junction.

At the bottom of a pipe driven from 10 to 15 feet under ground the temperature is practically constant from day to day providing it is not too near any underground furnace flues, steam pipes, etc. The temperature at the bottom of such a cold junction well may vary with the season of the year, but such changes will be gradual and a check every month or two should be sufficient to detect any serious change in cold junction temperature. By extending the special lead wires—often referred to as aux-

iliary lead wires, thermocouple extensions and sometimes, erroneously, compensating leads (the leads themselves being unable to compensate for fluctuating cold junction temperatures) —to the bottom of such a well, the cold junction temperature can be maintained constant. This method is used commonly and is satisfactory.

Adjust the Instrument

To properly adjust the instrument the actual cold junction temperature must be known, for in the case of the galvanometer type instrument without any automatic cold junction compensator or with a mechanical type of compensator, the zero position of the pointer, i. e., the position of the pointer with no e. m. f. impressed on the terminals of the instrument, as is the case when the instrument is on open circuit or not connected to any couple—must agree with the cold junction temperature. In other words, with the instrument disconnected the pointer should read the temperature of the cold junction. If it does not, then it must be made to do so by means of the zero adjuster on the instrument. In the case of a potentiometer equipped with a manually operated cold junction compensator the actual cold junction temperature must be known before this compensator can be properly set. As commonly arranged, i. e., with the cold junction at the bottom of a well, it is necessary to determine the temperature of the cold junction at the bottom of the well and this may be done by a mercury-filled thermometer lowered down the well. Such a procedure is not extremely accurate because the thermometer reading may vary as the thermometer is withdrawn from the well—particularly if water has condensed in the well, and wet the thermometer bulb. It is otherwise not entirely satisfactory, since the thermometer is liable to be broken and because at least 5 minutes should be allowed for the thermometer to reach equilibrium.

By a simple arrangement of the switch and leads the necessity of taking the temperature at the bottom of the cold junction well may be eliminated. Such an arrangement is shown in Fig. 1.

In this diagram, two couples are shown connected to one indicator. From the ends of the thermocouples auxiliary leads of the same material or having the same thermoelectric characteristics as the thermocouples, extend to a common zone box where they are soldered to copper leads extending to the selector switch. A common cold junction couple made

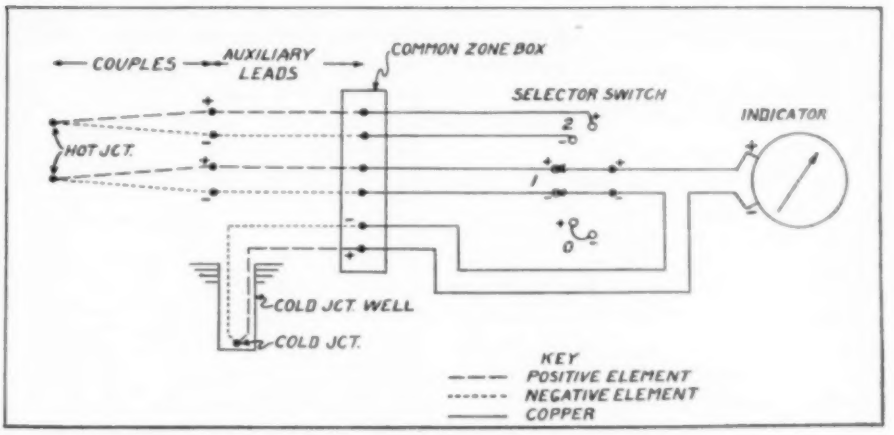

FIG. 1—WIRING DIAGRAM FOR INDICATING PYROMETER INSTALLATION

up of auxiliary lead wire is used and that it may serve either couple it is connected in between the switch and the indicator by copper leads, with the soldered connections between the actual cold junction couple and the copper leads in the common zone box. As long as all connections between the auxiliary lead wire and the copper leads are kept at the same temperature the length of copper leads does not affect the e. m. f. generated. It is not necessary that these connections be kept at a constant temperature as long as the temperature of all of them is the same and the common zone box, the purpose of which is only to keep all these connections at the same temperature, may be subjected to daily temperature fluctuations without affecting the accuracy of the installation.

Contacts Short Circuited

The switch is shown set on position 1 and the indicator would show the temperature at the hot junction of the couple connected to that switch position. As many couples can be connected to the switch as there are positions or points on the switch. On the zero position it will be noted that the positive and negative poles or contacts are short circuited with a short length of copper wire and that is where this arrangement differs from the usual arrangement using a common cold junction couple. With the switch on any position but 0 the common cold junction couple is connected in series with a thermocouple and the indicator, but with the switch on the zero position, the common cold junction couple is connected directly to the indicator and with reversed polarity. So connected, the indicator will show the temperature in the common zone box providing the zero setting of the indicator agrees with the temperature of the cold junction at the bottom of the well. If the indicator does not read the common zone box temperature, the zero setting does not agree with the cold junction temperature, but it can be made to do so by adjusting the pointer by the zero adjuster until it does read the zone box temperature. With this arrangement, there is no necessity for taking temperature at the bottom of the cold junction well. For determining the temperature in the common zone box a small mercury-filled thermometer permanently installed or temporarily inserted in the box, can be used.

Calculate Errors

Theoretically the resistance of the external circuit with the switch on 0 should be that for which the instrument was calibrated, but actually this is not essential if the instrument has an internal resistance of 200 ohms or over. For example, if the resistance of this circuit was 5 ohms less than the external resistance for which the instrument was calibrated the error in the reading of the instrument would be practically 5/200 or 2.5 per cent, but as the temperature at the bottom of the well is generally about 70 degrees Fahr. and the common zone box should not be located where the temperature will be much above 120 degrees Fahr., the difference in temperature is only 50 degrees Fahr. and 2.5 per cent of this is only 1.25 degrees Fahr., which would be the error introduced in the cold junction setting by the 5 ohms lacking in the external resistance of this circuit. This is generally as close as the zero setting usually can be made anyway and, therefore, is generally satisfactory.

Several manufacturers of pyrometers do, or will if desired, equip their instruments with automatic cold junction compensators. Some of these compensators are of a mechanical and some of an electric type. When automatic cold junction compensators are used the cold junction must be extended all the way to the tempera-

ture sensitive element of the compensator so that any change in cold junction temperature is accompanied by a like change in the temperature of the temperature sensitive element of the compensator.

One mechanical compensator consists of a bimetallic spiral interposed between the hand-operated zero adjuster and the control spring on the moving coil and so designed that after the zero position of the pointer has once been set to agree with the cold junction temperature the bimetallic spiral changes the zero position of the pointer in accordance with any changes in the cold junction temperature. With such a device, the auxiliary leads should extend inside the instrument case where the bimetallic spiral is located, for it is quite possible, when the instrument is located so that cold drafts or radiation from an open furnace can strike it intermittently, for the temperature inside the instrument to differ considerably from the temperature just outside the case. This does not mean that the binding posts must be inside the instrument case, but that auxiliary lead wire should be used from the inside ends of the binding posts and that these posts should be of heavy enough cross section to eliminate any possibility of appreciable differences in temperature existing between the outside and inside ends of the posts. With such an arrangement, the true cold junction will be inside the instrument and it always will be at the same temperature as the temperature sensitive element of the compensator. One manufacturer even goes so far as to make these binding posts, on instruments in which the temperature sensitive element of the compensator is located inside the instrument, of the same material as the thermocouple leads and then to use leads of the same material from the inside ends of these binding posts.

Electrical Compensator

One electrical type of compensator is constructed on the Wheatstone bridge principle. The temperature sensitive element is in one arm of the bridge and when the cold junction temperature varies from that for which the instrument was calibrated, an e. m. f. is added or opposed to that generated by the couple to compensate for the e. m. f. lost or gained by the decrease or increase in temperature difference between the hot and cold junctions caused by changes in the cold junction temperature. With this type of compensator the zero position of the galvanometer always must be maintained at a specified position on the scale, generally 75 degrees Fahr. or 25 degrees Cent. Furthermore, the current through the bridge must be kept constant and this is accomplished by turning the selector switch to the check position occasionally and turning the rheostat handle until the pointer of the instrument is at the check position marked on the scale of the instrument. This adjustment is simple and does not have to be made frequently. One ordinary No. 6 dry cell operates the compensator and will last for months.

Thermo-Elements

There are three different thermo-elements in common commercial use: platinum vs. platinum-rhodium, chromel vs. alumel, and iron vs. constantan. The platinum vs. platinum-rhodium can be used up to 3000 degrees Fahr. or higher, the chromel-alumel up to 2500 degrees Fahr., and the iron-constantan up to 1800 degrees Fahr. Although each of these can be used at somewhat higher temperatures than those mentioned they are not commercially practical above those temperatures. The platinum vs. platinum-rhodium couples require quartz or ceramic protection tubes, are costly and since other couples are more satisfactory, are not commercially used for measuring the temperature of molten aluminum. The chromel-alumel and the iron-constantan couples are both satisfactory for measuring the temperature of molten aluminum and although chromel-alumel is probably more generally used, the type of iron-constantan couple consisting of a constantan wire element inside a tubular iron element has certain advantages.

Since molten aluminum will alloy gradually with both the chromel-alumel and iron-constantan couples, it is essential for economical reasons that, when used continuously in molten aluminum, protection tubes should be used over the couples or that other means be employed to keep the molten aluminum out of contact with the thermocouple. However, even as the molten aluminum attacks the thermocouples so will it attack the protection tubes and as yet no metallic tubes have been found which will resist satisfactorily this attack. Ordinary cast iron seems to offer as much resistance to molten aluminum as any metal, even including the heat resisting alloys, particularly if covered with an oxide skin (rust or scale). Ceramic tubes are not satisfactory for this purpose, since they are broken easily by mechanical shock and cannot be plunged directly into molten metal while cold.

An effective method of protecting thermocouple protection tubes against attack by the molten aluminum consists in applying a protective coating to the tube. Whitewash made up of hydrated lime mixed with water in the proportion of one part of lime to one part by volume of water makes a wash that easily can be applied with a brush and produces a continuous and effective coating. If the tube is heated before the wash is applied, a better coating is obtained, but the tube should not be much above 180 degrees Fahr. when the wash is applied. Instead of applying this wash with a brush, the wash may be kept in a container about 6 inches in diameter and of the proper depth and the heated tube plunged into the wash once and quickly withdrawn. Another effective coating can be made by applying a wash consisting of one part of graphite—the ordinary plumbago used in foundries is satisfactory—to two parts by volume of water. This wash may be applied with a brush or by dipping.

Use Sodium Silicate Binder

When the thermocouple protection tube is suspended over an open pot and lowered into place for use, these coatings are satisfactory, but when the tube must be inserted through a hole in the wall of an open-hearth furnace the coating is apt to be scraped off in places, leaving the tube exposed to attack and after the molten aluminum has once started to alloy with the tube subsequent coatings will not stop it, for the affected spot cannot be freed entirely from aluminum. A coating much more resistant to abrasion can be secured, if, instead of plain water the lime or graphite be mixed with a solution of 25 per cent by volume of commercial sodium silicate solution and 75 per cent water. The sodium silicate acts as a binder and produces a good coating.

The protection tubes should be recoated once a day and before a fresh coating is applied all aluminum should be removed and any loose lime or graphite scraped off. When used in an open-hearth furnace where the tube is subjected to more abrasion it may be found advantageous to recoat more frequently.

It might be mentioned at this time that the same lime wash (lime and water) is equally effective when used on the inside of cast iron melting pots, ladles, skimmers, etc., not only to protect the iron from attack, but also to prevent contamination.

How and Why in Brass Founding

By Charles Vickers

Refining Copper Slag

We are sending a sample of copper slag and would like to know the proper kind of furnace to use to reduce it to metal. We could put the material through our crushers and over the concentrating table, but in that manner only the metallic portion would be salvaged and the metal in the oxidized state would be lost.

The proper kind of furnace to handle the material sent is a water-jacketed cupola in which it could be smelted with coke and fluxes such as iron pyrites and limestone. From the cupola it would emerge as impure copper ready to be put through the refining furnace which is usually a coal-fired reverberatory, and in which it is converted into tough pitch copper such as usually is found on the metal market.

However, such treatment would not pay unless there was a considerable amount of material to be put through the furnaces. From five tons or more could be produced per day in the cupola. With the oxidized and metallized slag all kinds of copper bearing refuse could be charged which would swell the output of the cupola. As a considerable sum of money will be required to install such equipment, it would not be wise to make such expenditure unless there was reason to suppose the equipment would be used continuously. Thus if used only one day or so a week, or month the interest and other charges would put the price of the reclaimed copper up to the point where money would be made by selling it to a smelter. We suggest the matter of the cupola be taken up with manufacturers of mining and smelting equipment and their views be obtained.

Melting Alloy Turnings

Can you inform us how to melt turnings of aluminum alloy to good advantage.? We have tried to do this but the metal appeared to be hard and spongy.

Start the melt off by charging some chunky material such as gates, or even an ingot or two to get a bath of liquid metal filling the crucible bottom to a depth of about 3 inches. Permit this bath to gather heat until it approaches a cherry red, or is around 1500 degrees Fahr. Then charge the turnings until the pool gets pasty, when it is again heated to a cherry, and the charging repeated. Of course the operation goes rather slow at the start, but as the depth of metal increases it goes fast enough. The secret simply is the dissolving of turnings as sugar is dissolved by water, which gives them no chance to oxidize or to combine with carbon or nitrogen.

When the pot is filled with metal allow the latter to get fluid and a dark red color, then throw on top a little zinc chloride and rabble it around. Pull pot, skim off the dry dust and pour. The resulting ingot will be just as good as any of the remelted gates and such material.

Using Scrap Brass

We have a considerable quantity of scrap brass rod of the composition copper 65 per cent; zinc 33 per cent; lead 2 per cent. Is this material adaptable for making sand castings and if so how should it be used?

The alloy is a yellow brass and although it is a little high in zinc for a good sand casting yellow metal, still alloys with this zinc content are being cast every day. If the castings are simple and not expected to withstand even moderate pressures, a little aluminum may be added as a flux. Use as little aluminum as possible; one ounce for 100 pounds being ample, and possibly half that quantity will be sufficient. This will depend on the success with which it is added. If it is allowed to change to its oxide before becoming alloyed, up to 2 ounces may be required. Therefore, the aluminum should be stirred in well.

As the composition of the metal is known it may be used easily in any ordinary alloy of red brass or gun metal, the proper proportion to be used in each heat being a simple calculation. In any alloy containing zinc, this scrap may be used to carry the zinc. The little lead it contains may be ignored for such alloys. The scrap may be used just as it stands either with or without aluminum additions, and it may be used as a component part of alloys such as red metal or gun bronzes.

Makes Plaster Molds

We desire the formula for a plaster mixture to be used for casting small, white metal patterns, the mold to withstand about 50 casts. Also a suitable white metal mixture to use in connection with the mold.

Some patternmakers have used dental plaster entirely for making molds in which to cast white metal, but they usually were satisfied when they obtained one casting from a mold, instead of 50. The most important matter to attend to is the drying of the mold. First it is dried for several hours at a low temperature, and then is heated rather strongly for a time. If the metal is poured into a damp mold, the experience will be instructive, though dangerous, and we warn against doing it. The plaster can be mixed with some refractory substance that will give the molds some degree of porosity. Finely screened carborundum fire sand, finely powdered brick and pulverized asbestos are used for this purpose. The more porous the mold the better, as it can be dried more easily. The steam can escape, also any gases produced in pouring the metal.

The following alloy is suitable: Tin, 7 pounds; lead, 7 pounds; antimony, 2 pounds.

Nickel Is Beneficial

If nickel-plated brass tubing, fittings, etc., are mixed in with scrap brass in melting, what effect does the nickel have on the brass?

The effect of small amounts of nickel on brass is anything but harmful. Hundreds of manufacturers of brass castings of all kinds deliberately add nickel to their alloys and find that it improves their alloys, or they would not go to such expense. It is now practically impossible to buy ingot alloys nickel-free due to the fact of plated goods carrying nickel into the melt. This does no harm at all, though some founders with a lively imagination occasionally blame the nickel for some difficulty the cause of which they are at a loss to discover. At the present time it is customary to specify nickel as a constituent of gear alloys because it has been demonstrated that such addition is highly beneficial to the castings.

Pyrometers Provide Check

Use of Exposed Couple Favored—Precautions To Be Observed in Obtaining Satisfactory Service Are Noted and Disadvantages Mentioned

By H. M. St. John

PYROMETERS now are available which, in the hands of a reasonably bright boy who has been trained for a week or two, will give more consistently reliable results than the most skilled and experienced eye. Once convinced of this, the expert foundryman breaths a sigh of relief and turns his attention to other things.

It is probably true that the pyrometer finds its sphere of greatest usefulness in the production foundry, where much the same castings are made day after day.

The problem is to so gage the temperature of the metal that the largest possible number of molds can be poured from a pot of metal without making scrap by pouring the first molds too hot or the last ones too cold. The number of molds which can be poured successfully depends upon the pouring range of the casting and the exactness with which the molten metal temperature is known.

By pouring range is meant the limiting temperature between which the metal can be poured into sound castings which will have the desired properties. This range may be as much as 100 degrees Fahr. or more, or it may be as little as 40 degrees Fahr., depending upon the design of the casting and the properties required of it. Any casting which must be poured at an exact temperature within limits of less than plus or minus 20 degrees Fahr. is not designed for economical handling in the foundry. If such a casting must be made a liberal scrap allowance is necessary.

As an illustration, consider a casting which can be poured successfully at any temperature between 2050 and 2150 degrees Fahr. If only one mold were to be poured it is obvious that almost anyone, given a little experience, could gage the metal closely enough with the eye to pour sound castings. No great accuracy is required if one has a margin of plus or minus 50 degrees Fahr. If, for the sake of economy in handling the metal, a number of molds must be poured from the same pot; the greater the number the greater the economy. Assume that the metal in the pot cools at the rate of 20 degrees Fahr. per minute and that three molds can be poured per minute. Then, if pouring is started at exactly 2150 degrees Fahr., 15 molds can be poured before the falling temperature reaches 2050 degrees Fahr. and the castings will all be good, so far as temperature is concerned. If, through inaccurate determination of the temperature, pouring is started at 2110 degrees Fahr. instead of 2150 degrees Fahr., and 15 molds are poured, the last six molds poured will produce bad castings. Similarly, if pouring is started at 2190 degrees Fahr. the first six molds poured will be bad. If, in order to play safe, only nine molds are poured instead of 15 there is a considerable sacrifice of economy. Evidently it is highly desirable to begin pouring precisely at 2150 degrees Fahr., or as closely so as may be practicable. With a properly calibrated pyrometer in capable hands it is possible to do this within plus or minus 10 degrees Fahr. Nothing like such accuracy is attainable in any other way.

Practical and Profitable

DESPITE several drawbacks the author is convinced from long practical experience that the use of pyrometers in the brass foundry is not only profitable but capable of nearly universal application. This article is abstracted from a paper presented at the Detroit convention of the American Foundrymen's association.

In the case of castings which have a pouring range of 40 or 50 degrees Fahr., and there are always some of these in almost every foundry, the pyrometer is even more valuable and necessary. The foundry superintendent, who formerly found it essential to give personal supervision to the pouring of such castings, will be relieved from an exacting and troublesome responsibility.

In our plant approximately 400 temperature readings per day are taken when the foundry is busy. The metal always is taken from the furnaces at a temperature higher than required for the work, that it may be cooled to exactly the desired temperature. With the electric furnaces the margin of excess superheat is slight since the temperature of the metal leaving the furnace can be predetermined closely. In the coke fires no such accuracy of control is possible and the superheat is commonly 100 degrees Fahr. or even more. The metal is taken to a skimming station, stirred and skimmed. It is cooled under the direction of the pyrometer operator, by stirring in gates or pigs until the temperature is supposed to be about 50 degrees Fahr. above the desired point. A reading then is taken and, based on this reading, the metal is cooled to the desired temperature, which is checked by a final pyrometer reading. Each pyrometer reading takes six seconds; the entire procedure, including stirring and skimming, is carried through in approximately one minute.

All temperatures are taken at the skimming station, rather than at the mold. The pyrometer man, who is a foundry employe, receives his instructions from the foundry superintendent for work on the floor and the metal temperature required for each class of work. In giving these instructions the superintendent makes due allowance for the loss of heat during transportation of the metal to the molds. This allowance is the result of both experience and test and can be made quite accurately.

As the metal leaves the skimming station, the pyrometer man hangs a tag on the ladle trolley, showing in large figures the result in his final reading. The pouring boss, in deciding how many molds can be poured safely in any class of work, is governed entirely by the temperature report shown on the tag.

All of our alloys are held closely to analysis. Composition ingot and other metals are purchased on rigid specifications and carefully checked to these specifications before use. In spite of these precautions, we find that the pouring quality of the metal is not a constant factor.

The best pouring temperature for any given casting varies from time

to time according to the quality of the metal used, in spite of the fact that there has been no change in the analysis. For example, in starting a new lot of ingot we discover that the metal is more fluid than befor and that it is necessary to reduce all pouring temperatures in order to avoid burned in and spongy castings. This variable is regulated by taking as a standard a casting which is in constant production throughout the year.

Change in Ingot

Suppose that the foundry has been pouring this casting at 2200 degrees Fahr. When a change is made from one lot of ingot to another, the first molds of this casting poured from the new mix are blown out and examined by the foundry superintendent or pouring foreman, who then decides whether a pouring temperature of 2200 degrees Fahr. is still suitable or whether a change of 20 or 30 degrees Fahr., up or down, should be made.

If a change is made with respect to this casting, a similar change is made throughout the foundry whereever this particular metal mix is used. This works satisfactorily on the general run of our work, where the pouring range is 100 degrees Fahr. or more. Where the pouring range is only 40 degrees Fahr., or thereabouts, it is essential that the metal used be uniform, day in and day out. This uniformity can be accomplished whenever the results to be obtained justify the expense of doing so.

Lack of uniformity in the fluidity of composition ingot, scrap copper and the like probably is due to a variation in dissolved oxides and the presence of other impurities in various physical states, the nature of which always cannot be determined by chemical analysis.

The pyrometers used are of the exposed-couple, base-metal type, with low-resistance, portable meters. The tips are 19½ inches long and average better than 125 readings per pair. All pyrometers are checked twice a day in the foundry against a standard instrument. At the slightest evidence of inaccuracy the meter under suspicion is withdrawn from service and rechecked in the laboratory. Usually repairs and adjustments are made in our own laboratory but occasionally—about once in six months—the meters are returned to the makers for a thorough overhauling.

In reading molten metal temperatures with an exposed couple a number of precautions must be observed carefully. A certain aptitude on the part of the operator also is required. Nine men out of ten can acquire the necessary skill without difficulty. Any foundry, jobbing, or otherwise, of any size, no matter how small, will profit by the intelligent use of an up-to-date pyrometer. Many difficulties now encountered may be eliminated or may be attributed to the proper cause.

Brass foundry pyrometry, in the present state of the art, is by no means so perfect as it should be. The use of an exposed couple has the advantage of giving a consistent reading in six to eight seconds but the method is not so foolproof as might be desired. The use of a protected couple reduces variations due to the human element but, in our opinion, it takes far too long to get a reading. The constant checking of meters and couples is rather a nuisance; it is to be hoped that pyrometer manufacturers will soon be able to improve this condition.

Welds Old Bell

The welder's art has brought to life at Taunton, Mass., an old 900 pound bell which was cracked some 40 years ago, and which remained silent from that time until Feb. 12 of this year. The work of repairing, which was done with the bell in place, was under the direction of the General Electric Co. The crack, 17 inches long and varying in section from 1 inch to 2⅝ inches, was chipped out, cleaned and repaired for welding. The bell was first preheated and then a welding operator with a carbon arc type welder started building up the crack. He finished the work with the metallic arc process. The bell was cast in 1808 by George Holbrook, an apprentice of Paul Revere.

Hunts Old Issues

The New York Public Library is seeking to complete its file of back issues of THE FOUNDRY. Anyone possessing copies of this publication sought by the library will confer a favor upon that institution should they care to deposit these old files in a place where they may be accessible to the great number of readers who frequently inquire for them. The library needs the following:

All numbers previous to Vol. 6, No. 32 (1895); also Nos. 33 to 39, 59, 65, 67, 68 and 70 to 76 (previous to Vol. 14, (1899).

The editors of THE FOUNDRY will appreciate hearing from old-timers who may have these numbers in their possession.

Buffalo Foundrymen Hear Historical Talk

At the regular monthly meeting of the Buffalo foundrymen's association Feb. 16, Pat Dwyer, engineering editor THE FOUNDRY in an interesting manner traced the development of the foundry industry, moralizing on some of the aspects of the subject, drawing conclusions from others and directing attention to the revolutionary methods seeping into the industry principally as a result of the phenomenal growth of the automobile business. An exceptionally large number of members attended the meeting and included many from Lancaster, Depew, Lockport and Niagara Falls. Entertainment features and a fish fry provided by the secretary W. J. Wark, E. J. Woodison Co., Detroit, held the attention of the gathering until midnight.

Projects Are Underway

The Austin Co., Cleveland, recently asked for quotations on material requirements for 1927. The total value of the materials listed is in the neighborhood of $10,000,000. The requirements of that company may be appreciated more readily when it is known that approximately 100 construction projects now are under way. These projects include complete units costing over a million dollars as well as small plant additions and separate buildings.

To Hold Spring Meeting

Spring meeting of the American Society of Mechanical Engineers will be held at White Sulphur Springs, W. Va., May 23-26.

Time usually devoted to inspection trips when the meeting is held in an industrial center will be occupied by programs of sports, by side trips of historical interest and by programs of golf, tennis, etc.

Study Aluminum Bronze

The Aluminum Bronze Manufacturers institute has been organized by several metal companies to study the alloy named and to promote its use. W. M. Corse is director of the institute, with headquarters at 810 Eighteenth street, Washington. The following companies are members: American Metal Products Co., Milwaukee; Buffalo Bronze Die Cast Corp., Buffalo; Duriron Co., Dayton, O.; Hills-McCanna Co., Chicago; Michigan Smelting & Refining Co., Detroit.

The Edgewater Beach Hotel, Headquarters for the Annual Convention of the American Foundrymen's Association, June 6 to 9, May Be Reached on the Elevated Lines or on the Motor Coach Lines

Chicago Attractions Excel

CHICAGO, scene of the 1927 annual meeting of the American Foundrymen's association, is one of the most beautiful cities in the world with unrivaled attractions and points of interest for the visitor. The city may be seen to great advantage over the network of drives and boulevards which follow the shore of Lake Michigan for miles or interconnect the hundreds of parks maintained by the city, extending from Jackson park on the south to Lincoln park and Sheridan road on the north.

Beautiful Drives Numerous

Many motor coach routes cover the boulevard systems and provide an enjoyable method of seeing the beauties of the Midwest metropolis. One of these routes goes from the heart of the downtown section to the city limits on the north, passing on the way the Edgewater Beach hotel, convention headquarters in June. This trip starts from the famous Loop district, passes over the Michigan boulevard bascule bridge, past the Wrigley building, Tribune tower, and the smart upper drive shopping district. The route then passes the old water works which was erected in 1867 and was an active factor in fighting the fire of 1871, through the Gold Coast residential section, where some of the pretentious homes of the city may be found, and at North avenue enters Lincoln park.

Points of interest in Lincoln park include the Zoo, the large aquarium and the Museum of Natural History. From the park, the motor coach route follows Sheridan road the beautiful drive along the north shore. A motor coach route to the west includes Humbolt, Garfield and Douglas parks while routes to the south pass Washington and Jackson parks, as well as the University of Chicago.

Chicago knows the value of Lake Michigan to the city and has spent millions in developing and beautifying the lake front. Grant park, located on the lake front opposite the Loop district, contains the Field Museum of Natural History, made possible through the gift of $9,000,000 from the late Marshall Field, the Art Institute and the Stadium, scene of the famous football battle between the Army and Navy last fall. When completed, that vast arena will seat 160,000 persons. The Public Library is located on Michigan avenue near the Art Institute. The Municipal pier lies directly north of the downtown section and extends nearly a mile into the lake.

Hotel Facilities Excellent

In selecting the Edgewater Beach hotel, the committee has secured an ideal location for the annual gathering. The hotel is located in the 5300 block on Sheridan road and may be reached on the elevated to the Edgewater Beach station or, as has been noted, on the buses. The hotel maintains the atmosphere of a club and provides music and entertainment of the highest order, has extensive lawns and gardens with beach promenade, private bathing beach, private motor coaches to business and shopping district and a garage accommodating 200 cars.

DEBATE PIG IRON QUALITY

Annual Meeting of Institute of Mining and Metallurgical Engineers Conducts Round Table on Quality of Blast Furnace Metal—Foundry Interests Represented

INCREASING importance of alloys in production of pig iron was emphasized at the 135th annual meeting of the American Institute of Mining & Metallurgical Engineers held recently at the Engineering Societies building, New York. With nearly 1500 members and guests registered on the second day, the meeting took its place as one of the most important in the institute's history.

At the business meeting E. L. DeGolyer was elected president. Two new vice presidents were elected and several directors. At the banquet Wednesday night medals were conferred on David W. Brunton and Zay Jeffries. In the institute of metals division Prof. Cecil S. Desch, Sheffield university gave the annual lecture. His subject was the growth of metallic crystals.

Research Needed

During the past quarter century the quality of foundry pig iron gradually has declined according to Dr. Richard Moldenke, Watchung, N. J., who opened the round table discussion on pig iron. This deterioration started with the cold blast charcoal pig iron, the anthracite iron, the coke iron, then gradually from warm to hot blast coke iron, and finally the present day hot blast coke irons with scrap additions that in some cases have reached as high as 65 per cent. One of the problems bearing on present day practice, according to Dr. Moldenke, is the lack of systematized knowledge based on correct fundamentals. He urged more extensive research work as an important means of increasing quality.

British Practice

In the discussion following this paper A. Marks of England told of a British research association which secured the benefit of individual investigations of nearly all important foundries in England. He urged the formation of such an association in America. He said that here many foundries carry on important studies pertaining to their own individual problems, and that other foundries seldom benefit from any general conclusions which thus may be reached. Mr. Marks said that the use of scrap was increasing in England. He told of one large manufacturer of diesel engines which operates its own blast furnaces, two of which are run on low phosphorus iron.

The war had a great effect on increasing quality of castings in England according to Mr. Marks, who said that before the war the average tensile strength of general castings was about 25,000 pounds per square inch. Now the average strength is almost 50,000 pounds per square inch.

E. J. Lowry, Hickman, Williams & Co., Chicago, in discussing Dr. Moldenke's paper brought out the important point that responsibility for the present poor quality of pig iron must be placed at the foundrymen's door. Furnaces cannot be expected to increase the quality of their product when foundries continue to buy on a strictly price basis.

W. B. Coleman in a paper on copper bearing pig iron described the result of many tests as a result of which he stated that additions up to 1 per cent metallic copper to molten iron do not seem to alter the physical properties of the castings. Further, he said that a blast furnace operating on a burden carrying copper bearing ore may produce a grade of pig iron highly suitable for the manufacture of small castings by production machine methods. If pig iron is remelted under conditions which produce ferrite in the castings, greater machinability also will be produced.

Shows Alloy Effects

Ralph H. Sweetser, American Rolling Mill Co., Middletown, O. who presided at the round table discussion on pig iron presented a mass of material illustrating the effect of varying percentages of total and combined carbon in pig iron. Mr. Sweetser showed tests where total carbon ran up to 4.60 per cent or more.

James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., said that he had never known a commercial pig iron to take up more than 4.20 per cent of total carbon. In discussing this point Mr. Sweetser said that the total carbon frequently was the same in the product of a sick furnace as it was in the product of a good furnace, and that the total carbon alone could not be taken as indicative of quality.

Recognizing Oxidized Iron

The question of oxidized iron was considered from many angles. Mr. Coleman and others were of the opinion that it is impossible to correct the effect of oxidized iron in the cupola. Dr. Moldenke said that practice in Germany which has made possible extremely high temperatures through the use of a combination of oil flame and air blast has succeeded in deoxidizing iron. Temperatures reached in this work have been as high as 3000 degrees Fahr. The question of how oxidized iron can be detected by the foundry was brought up for discussion, but was not answered satisfactorily. Apparently foundrymen without special equipment cannot tell whether their pig iron is oxidized before they use it.

Prof. D. J. Demorest, Ohio State University, Columbus, O., stated that the quality of scrap used either in the blast furnace or in the cupola

(*Concluded on Page* 199)

Officers Elected

President

*E. L. DEGOLYER, petroleum geologist, New York

Vice Presidents

JOHN L. AGNEW, President International Nickel Co., of Canada, Ltd., Copper Cliff, Ont.
RALPH H. SWEETSER, assistant to vice president, American Rolling Mill Co., Middletown, O.
BIRCH O. MAHAFFEY, vice president, Silurian Oil Co., St. Louis.
CARL A. MEISSNER, United States Steel Corp., New York.
*GEORGE OTIS SMITH, director, United States Geological Survey, Washington
*F. JULIUS FOHS, consulting oil geologist, New York

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GEORGE M. CALLOW, New York
*FRANK H. CROCKARD, Woodward Iron Co., Woodward, Ala.
*J. O. ELTON, Salt Lake City, Utah
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*DANIEL C. JACKLING, San Francisco
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*RICHARD PETERS, Jr., Chester, Pa.
HARVEY S. MUDD, Los Angeles
RENO H. SALES, Butte, Mont.
CHARLES F. RAND, New York

*—newly elected

Bill Favors More Giddy Hats

By Pat Dwyer

EARLY last summer just after the official straw hat season opened, the hour being high noon and the inner man craving sustenance, I accompanied a young man on the daily pilgrimage to a place where the worn tissues are renewed and the old frame fortified for the exhausting duties of the afternoon. At various times, principally after a substantial breakfast I have toyed with the idea of dispensing with the noonday repast. I know several men who do it and who boast that their efficiency is increased to a remarkable extent. Just between ourselves I am not particularly interested in the efficiency angle, but I have had dreams of what I might accomplish with the vast sum I might save in say 50 or 60 years. On a modest estimate of $1.00 a day, 300 days a year compounded semiannually the total is fairly staggering. On the other hand as you might say, my chance of existing 50 or 60 years in a semi-starved condition is rather problematical. Also, and this really is the most serious feature, up to the present I have found no way of escaping the pangs of hunger which begin to assail me about 11 a. m. and which increase with geometrical progression and intensity up to noon. Without going too deeply into the subject I feel reasonably assured that if I could find a solution for the first part of the problem the second part would adjust itself automatically. The experiment is worthy of serious thought and some day, perhaps, when I am not too hungry, I shall give it the consideration it deserves. In the meantime, partly through life-long habit and partly as a measure of prudence, conserving the health and strength and all that kind of thing, I shall continue to stick my feet under the table at noon in the usual manner. Slow and sure, that's the ticket.

However, the foregoing is merely a digression and has no direct bearing on the tale of the hat. To a certain extent it may be regarded as relevant in that it provides the setting, the necessary background of circumstances leading up to the tragedy. Personally I am ashamed to admit that to me the episode presented all the earmarks of a comedy. Nothing extraordinary about that. Something like 2000 years ago a gent in a short skirt named Aesop—what's that? Certainly I mean the gent. This was a male skirt anyway. Some thing like 2000 years ago Aesop referred to the same trait in human nature. I would repeat the story, but I know you have anticipated me. The one where the persecuted frog remonstrated with the wicked and stone throwing little boy. "What's fun for you" he pointed out in a perfectly gentlemanly manner "Is death for us!" Needless to say the hat was not mine.

This particular hat, ornamented with a bright red, white and blue band topped off the lengthy frame of my friend. It was as conspicuous as the famous white plume of Navarre, or an oriflame going into battle. The owner considerately drew no invidious comparison beyond an occasional remark to the effect that the possession of a new and stylish hat tended to increase the sum total of human happiness. Each time I saw the image of my own modest head gear reflected in a plate glass front I felt more and more like a worm. I might just as well have been wearing a last year's bird's nest.

However, all things come to him who knows how to wait and I did not have to wait long. We turned the corner on Superior avenue where the four car tracks emerge from the subway entrance to the High Level bridge. A sportive gust of wind caught the hat, whirled it aloft and then deposited it neatly on the rail just as one of the cars came storming up the grade from the west. The owner of the hat gave vent to one startled bleat, like a sheep that falls through a hole in the ice, and then stood petrified. A horrified glance at the stream of traffic showed the utter futility of attempting a rescue. Even if the street had been clear and our hero had been endowed with the wings of an eagle he could not have snatched the hat in time to escape the wheels of the advancing juggernaut. I am not quite certain, but from my position as a totally non-partisan and only slightly interested spectator, I think I noticed that the motorman

A THING OF BEAUTY IS A JOY FOREVER

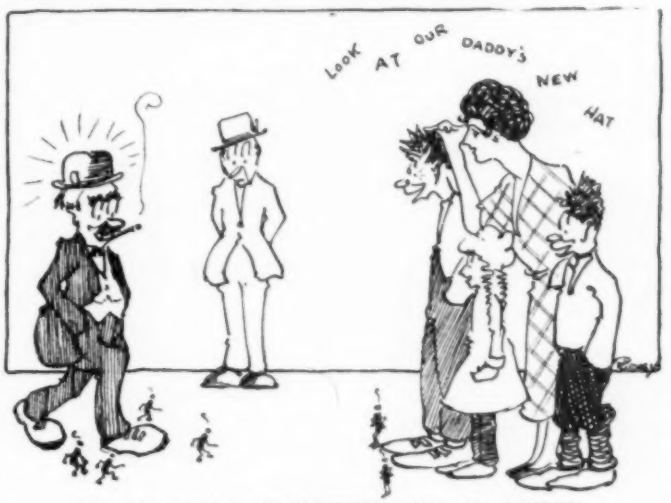
shoved the controller handle forward another notch when his eye fell on the hat. Even at the best, the daily grind of a motorman must be rather monotonous. Why should we begrudge him the few simple pleasures that come in his way.

Wheels of the front truck mashed the hat into a fair mess of junk and left it turned partly on edge. The air cylinder under the car turned it over and left it in perfect position for the approach of the wheels on the rear truck. After the car had passed, the remains of the hat resembled the mortified remnants of a shredded wheat biscuit coyly dragged from a garbage can by an alley cat. Without exaggeration I might say it was wrecked beyond redemption. The owner made no attempt to redeem it. He left it there. So did I. "Well," says the impatient reader, devouring this junk with the keenest relish. "What about it? Hundreds of hats, perhaps millions are lost every year. This here bird must have a curiously perverted idea of the value of time if he thinks I am going to waste any more of mine. What do I care if he lost his hat? My only regret is that his silly old head was not inside it."

Steady as she goes m'lad. Count ten. The foregoing exclamation of impatience is not only grossly unjust, but it is painfully inaccurate. In a calmer moment you will realize this is just another example of the danger of jumping to conclusions too hastily. I did not say I had lost *my* hat. However, I will admit that I was leading gradually up to another incident in which I figured as the victim and intended to draw a lesson or a moral or something of that kind. The point of view changes in a startling manner depending on whether a person is playing the party of the first or second part. You may have noticed instances of this kind in your own experience. Whether you have or not, take my word it is so.

Even in the best regulated families differences of opinion occasionally arise. I hold to the common sense view that clothing merely is intended as a covering for the body, a protection from the heat and cold and incidentally as a convention of civilized society. So long as it holds together in fairly presentable shape I can see no reason for changing one suit or one hat for another. A natural gift in the selection of colors leads me to wear black or dark clothing. It is selected personally and without assistance. Gradually all my other buying prerogatives have faded out of my hands. In a manner of speaking I am now in the last ditch and the future outlook is none too promising.

A certain lady holds views diametrically opposed to mine on the subject of clothing. It may be hereditary. Tartans of the wild Highland host who marched to the lilt of "Charlie Is My Darling" in the dark and stormy days of the '45 were no symphonies in purple and black. The vivid and barbarous colors of the plaids matched the emerald verdure, the gold and purple of the gorse and heather splashed with the scarlet life blood of many a gallant gentleman who swung Scotland's broad claymore for the last time on the ill fated field of Culloden.



THE RECEPTION COMMITTEE GETS AN EYEFUL

Far be it from me to interfere with the choice of colors in which a lady may choose to deck herself. As a free and—more or less—independent citizen, I have battled manfully for many years against insidious propaganda designed toward my conversion in color schemes. When I bring home a new suit I am greeted with a chorus of deep groans indicating disapproval, disappointment and a settled conviction that I am hopeless, a total loss. I am asked, nay even implored to look at other men of our acquaintance and note how snappy and up to date they appear in their sporty clothes. If I am so dumb as not to take a proper pride in my personal appearance, at least I might have some regard for the feelings of a family of which, nominally, I am the head.

One particular hat was a thorn in the side—not my side—for several years. In a temporarily flush period I bought a beautiful black imported hat. It was a pippin, a bird, a— a—well you know what I mean, it just suited me. I wore it in the spring and the fall and the winter and I would have worn it in the summer only for silly convention that forces people to adopt straw hats during that season.

When the second year rolled around I was properly indignant to find it packed away in a miscellaneous collection of feminine head gear that had flourished for varying short periods during the year. I rescued the faithful old bonnet and wore it for the best part of a year despite the most vigorous protest. Then I hid it away. I was taking no chances of being told in the fall that the old clothes man had got his claws on it. When I mentioned this little precaution to the lady she said she had no intention of giving it to the old clothes man. She was going to shove it in the furnace. The world rolled on or turned on—I have forgotten which—in the lathe of time, as our mutual friend Mr. Langson Smith remarked poetically once upon a time and then came a day when I had to depart for the Detroit convention. I had been wearing the hat for three or maybe four years and regarded it as much of myself as my hair. I got myself a new suit, but saw no reason for squandering money on a new hat while the old faithful friend practically was as good as ever.

The suit was not criticized, but at the same time no member of the family begged me to put it on so that it might be admired properly. An air of expectancy seemed to prevail and finally I was asked if I had a new hat. I said:

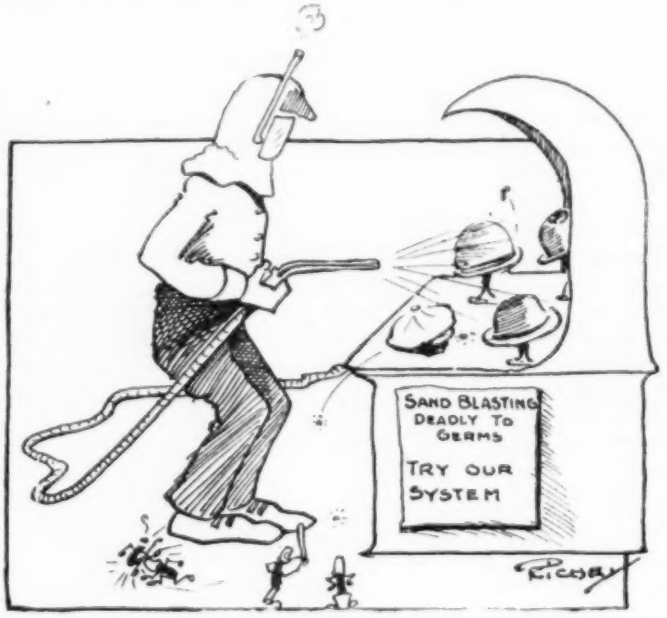
"Certainly not. What do I want with a new hat when I already have a perfectly good hat?"

"Was there ever such a man," wailed my wife. "Here he has been wearing the same old wreck for the past 20 years"—of course that was a gross exaggeration, it was not more than 5 at the outside—"and now he proposes to mingle with some of the most smartly dressed men in the country with the same old disreputable lid on his head. Look here," said she, addressing me directly and fixing me with the glittering wifely eye—both of them in fact—"Look here, if you go in that hat, you will go alone."

There it was, no ifs or ands or buts, a clean cut ultimatum. I realized immediately—and of course she

knew in advance—that all I had was Hobson's choice. For the sake of appearances, to preserve my dignity in the face of an abject surrender I said I would take the subject under consideration for a day.

That night I brought home a giddy light gray lid with the rim cocked up at the back and at one side, but with the other side and the front drawn down at a perfectly devilish angle. I intended it as a caricature, a stern and salutary lesson against frivolity in dress. My wife said it was a darling, it, not me mind you. She claimed it was adorable, in fact it was the only respectable hat she ever had seen me wear. I wore the hat during the convention and was subjected to a considerable amount of light and airy persiflage from friends and acquaintances accustomed to my usual sober raiment. In the vain hope that it would blow away I took s t a r t l i n g chances on windy corners, on the tops of busses and close to the lee rail of the boat on the journey going and returning. I could not lose it. Once more in the old home nest I hung it on the only hook in the closet which I can call my own. Then I put on the old reliable and stepped forth at peace with the world.



SANDBLAST IS BECOMING MORE POPULAR EVERY DAY

Alas and alackaday, the peace did not last long. A few weeks ago after a partial thaw and a rain storm, the asphalt pavement of the street was in a particularly filthy condition. On this day of all days an eddy of wind snatched my faithful friend from my head, deposited it in the slush, rolled it over and landed it against the curb on the opposite side, plastered. Fortunately I was alone at the time and thus probably escaped arrest on account of inflicting grievous bodily harm on any person who might have been prompted to offer sympathy. People who saw me walking back to the office bareheaded naturally assumed I was a collegian and offered no comment.

I was forced to drag out the spare lid on the following day and I have been wearing it ever since. Eventually, I may grow accustomed to it. The loss of the old hat was a sad blow, rendered doubly so by the callous indifference displayed by the lady of the house. In fact when I arrived home at night and narrated the sordid details of the melancholy incident she assembled the entire family and called for three rousing cheers. I regret to say they were given with a will.

Bill noted the new hat with approval while we were in Detroit. It lacked the gorgeous band with which his was adorned, but he graciously admitted it was pretty fair for a beginner.

"Stick around with me kid," he remarked handsomely, "and eventually I'll have you wearing a real hat. Black ones are alright for dead ones, undertakers, chief mourners, scarecrows and those pathetic creatures who imagine that the possession of a high black hat will lift them above the common herd and render them worthy to stand on the platform while the train bearing a 2 x 4 visiting royalty goes whizzing past. If you want to trail around with the live ones, try to act and dress as if you were alive. You will be dead long enough to become perfect without rehearsing the part in advance."

He offered no sympathy the other night when I told him of the ultimate fate of the old black hat.

"It is a wonder to me," he said in his best sarcastic manner, "that you did not hawk it out to the shop and ask me to soak it for an hour or two in the pickle tank to remove the scale. Come to think of it perhaps a pass or two through the sandblast chamber would have done the trick. That reminds me of a couple of castings a lad sent me the other day with an inquiry on the cause of the defects.

"The casting was for an electric iron in which the molten iron was poured around a length of seamless square steel tubing containing the heating element bedded in a calcined material. He said the inserts were prepared by heating for an hour in a gas-fired furnace to a temperature of 1200 to 1500 degrees Fahr. and then sandblasted. Therefore they were neither damp nor covered with oxide to produce the blowholes appearing in the castings. One casting was poured in sand and the other was poured in an iron mold. A small amount of aluminum in each ladle seemed to reduce the size of the holes, but the percentage of scrap still was too high. Examination of the castings indicated that despite expectations the tube containing the heating element was covered with a film of oxide and therefore responsible for the blowholes. Although the castings only showed a hole at one point I had suspicions and broke them apart at several points. Just as I suspected the cavity was continuous from one end to the other in the casting poured in the permanent mold, but only showed in a few places in the casting poured in sand. This, of course was due to the fact that the iron poured in the permanent mold solidified almost instantly and trapped all the gas evolved from the insert. In the sand mold the iron solidified more slowly and some of the gas had a chance to escape.

"Heating the tube for an hour to a temperature of 1200 to 1500 degrees Fahr. left it covered with a film of oxide. Apparently the sandblast cleaned the majority of the tubes, but those that were skipped caused trouble. In fact I should not be surprised if he were to find concealed cavities in some of the apparently perfect castings if he were to break them open. Since he was making the castings in large numbers I suggested that the only commercially practical cure for the trouble was to cover the tubes with a thin film of tin. The tubes to be pickled to remove the oxide film and then dipped in a bath of molten tin. And that," said Bill, "is no high hat stuff!"

New Members Elected

At the February meeting of the New England Foundrymen's association the following firms were admitted to membership: New York Sand & Facing Co., Brooklyn, N. Y., and Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

Lathe Attachments Aid Patternmaker

By Walter C. Ewalt

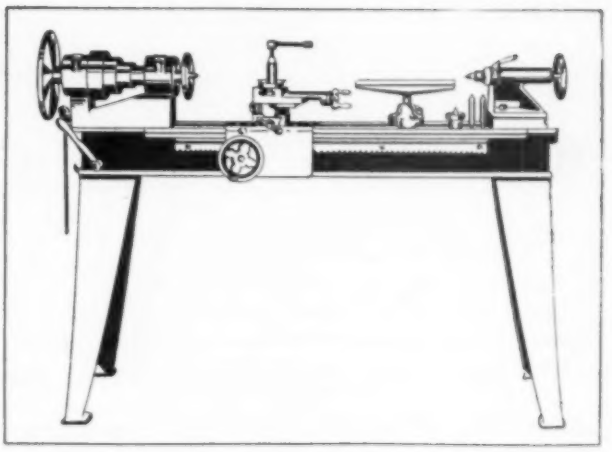


Fig. 1—Simple type of lathe having a 12-inch swing, bronze bearings and a cone with four steps

VARIOUS types of lathes used in the patternshop differ chiefly in the size of work which may be handled, since same attachments may be obtained for practically all types of lathes. These attachments may be used to advantage in cutting off wood, whether cylindrical, radial or tapered, and in grinding, boring or drilling. In fact the modern woodworking lathe is similar in many ways to the metal working lathe, including the power feed carriage.

The compound rest probably is the improvement of greatest value made on the lathe which formerly used the hand tools entirely. This device enables the operator to make drafts on patterns easily. This feature also makes it unnecessary for the operator to keep the cut straight with a straight edge, as is the case when turning with the hand tools. The compound rest may be installed easily and cheaply on many old type lathes which now are in use.

The size of work governs the type of lathe which should be used in the shop. A speed lathe will be entirely satisfactory in a small shop where small work is being done. This lathe may have a 12, 14 or 16-inch swing and be 4 or 5 feet long. The buyer may choose between the simple belt-driven machine and the more expensive motor head lathe.

A simple type of lathe is shown in Fig. 1. This machine has a 12-inch swing, the spindle is made hollow of crucible steel and the front end is treated to receive face plates, hollow chucks and screwed chucks. The bearings are split bronze and the cone has four steps. The end thrust is taken care of by the cone pulley pressing against the bronze bushing and the adjustment is made by expanding the cone. The lathe may be obtained with the plain rest or with a compound rest as shown in Fig. 1, and with a simple belt drive or a motor head.

Apparently 1000 to 1500 feet per minute is a safe speed at which turning should be done. The following example shows the method of determining the speed. With a piece of wood 11 inches in diameter, the correct speed for turning is as follows: $11 \times 3.1416 \div 12 = 2.88$. Then $1000 \div 2.88 = 350$, or the approximate number of revolutions per minute.

To a great extent judgment and experience determine the speed that should be used. The larger and heavier the pattern, the slower it

Fig. 2, 3 and 4 —Several types of face plates which are used in the woodworking shop

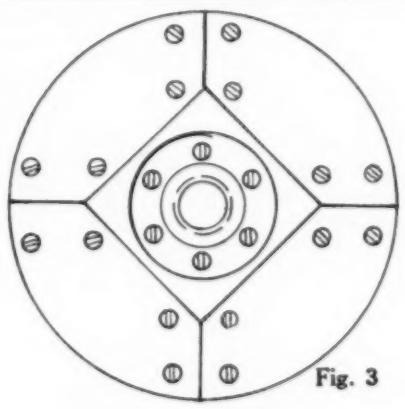


Fig. 3

Many patternmakers prefer the type shown in Fig. 2 as it may be constructed easily

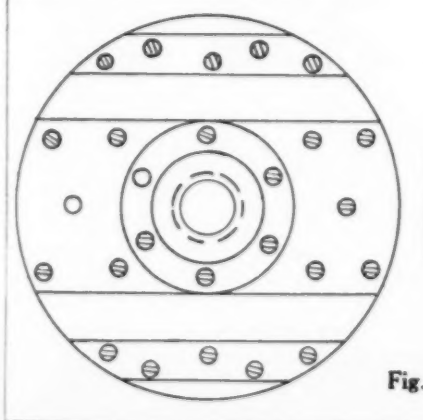


Fig. 2

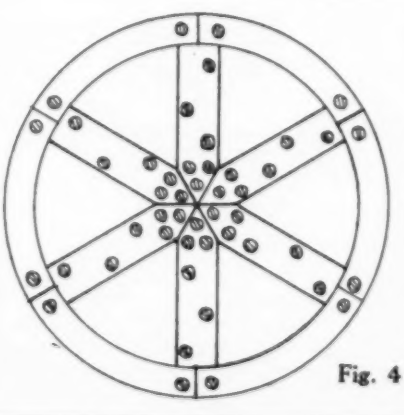
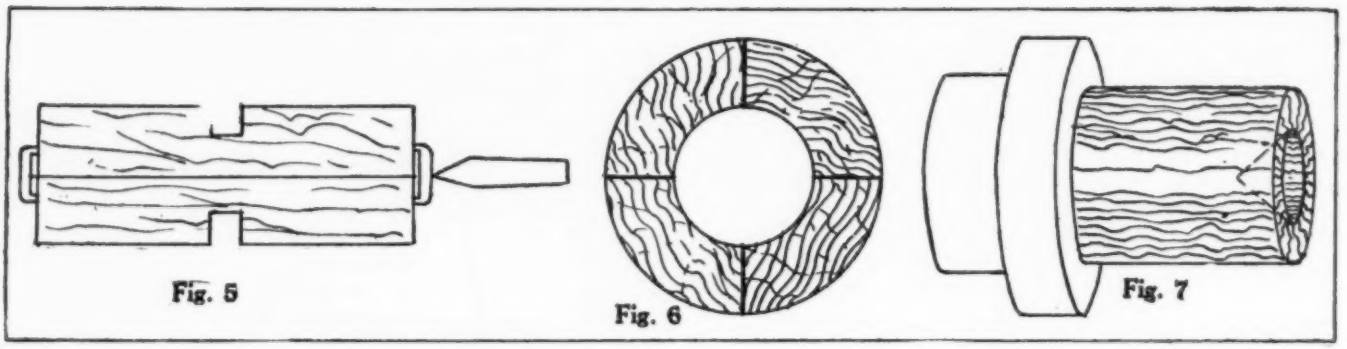


Fig. 4



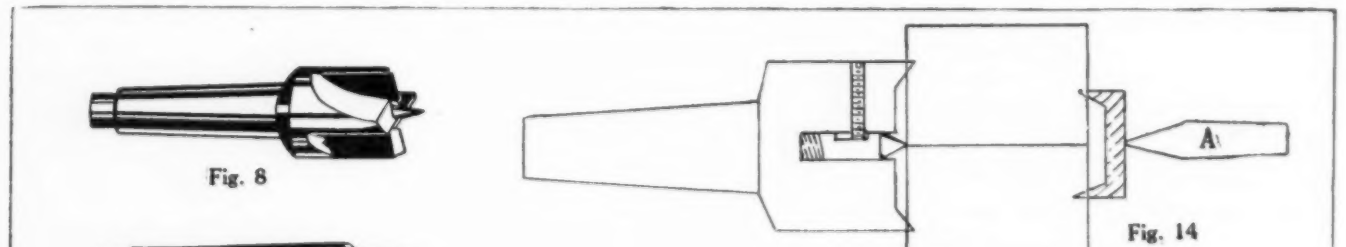
FIGS. 5, 6 AND 7—SHOWING METHODS OF TURNING WITH THE GRAIN, ACROSS THE GRAIN AND THE END GRAIN

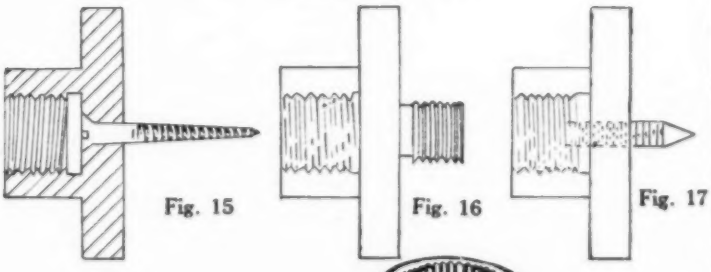
should run. If the wood is shaped roughly and is considerably out of balance at the start of the turning, it may be noticed in the vibration of the lathe and a slower speed used. When the work is nearly finished, a higher speed may be used. It is a good idea to mark the speeds on the headstock opposite the cone steps. This makes it easy for the pattern-maker to figure the correct speed.

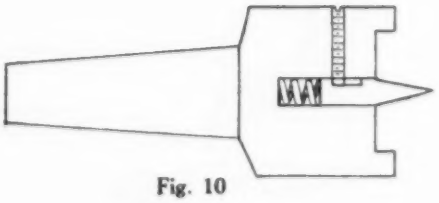
Three conditions are met in turning. The wood is turned with grain as seen in Fig. 5, across the grain as in Fig 6 and the end grain as in Fig. 7. If a groove on the circumference of a cylinder is being turned, the operation is turned with the grain. If a block of wood is faced off, the operation is turned across the grain, although one half the turning is with the grain. The principal reason for turning in a lathe is to make the work round and true. Again turning in the lathe is much easier than any other method when making different shapes and forms such as hollows, rounds, bends, drafts, etc. A fine finish also may be given by using the proper tools.

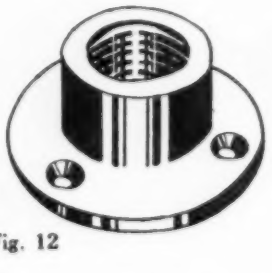
If the shop has a variety of small and medium-size work and only one lathe is to be purchased, a 16 to 20-inch swing patternmaker's lathe will be found the most convenient.

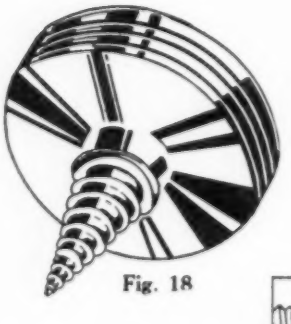
With some types, the headstock whether belt or motor driven, may be swiveled for turning tapers or drafts to 5 degrees from the center. The tailstock has a set-over device for taper work and it also is furnished with a compound rest. This

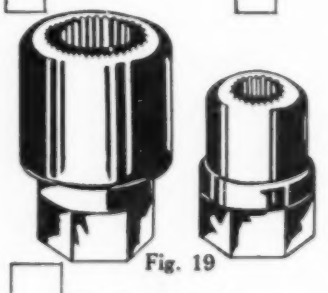


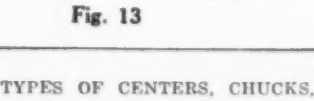


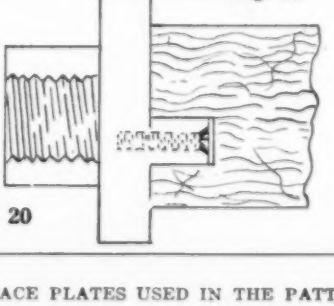












FIGS. 8 TO 20—VARIOUS TYPES OF CENTERS, CHUCKS, FRICTION PLATES AND FACE PLATES USED IN THE PATTERNSHOP

gives three opportunities for taper work. For larger work, the gap lathe, such as was shown on page 148 of the February 15 issue of THE FOUNDRY may be used.

Because the patternmaker turns split patterns as well as solid patterns, which are of various forms, a number of attachments are used to hold the work. The following figures represent some of the different methods of attaching the wood in the lathe for solid or split patterns. Fig. 8 is the common spur center or live center. Fig. 9 is the cup center or dead center and Fig. 10 is another spur center, the center pin of which is loose but is held outward by the spring until the point is forced back, when the wood backs into the jaws. This is a convenient center to use with split patterns as the pin point goes back instead of entering the wood. In that case the common center may cause the halves to open or to force the pin to one side of the center. Fig. 13 shows a center with a thin thread cut on the end.

A live and dead center, with a friction plate is shown at Fig. 14. The live center is similar to Fig. 10, that is, shaped like a cup which draws the two halves together. The outside edge may be notched to hold the wood better when turning. The dead center is the ordinary cone type which centers into a friction plate. With large split patterns a plate 5 or 6 inches in diameter, with a hole through the center the diameter of the dead cup center, may be screwed at that end to hold the two halves together.

A few face plates are shown in Figs. 15, 16 and 17. Fig. 15 commonly is called a screw chuck. One similar to Fig. 13 is shown at Fig. 16, having a thread upon which the wood is screwed. Fig. 17 has an adjustable center for special cases, where the center of the work is in a recess. Fig. 12 is another type of common screw chuck having a number of screw holes. This chuck is used commonly for split patterns. Fig. 11 is a similar chuck having one-half of the face raised 1/16-inch to aid in centering split patterns. Fig. 18 is another type of chuck. A wrench is used on the back of the chuck to screw it into the work and the chuck then is screwed into a threaded face plate. Fig. 19 is a hollow chuck in which the opening is corrugated and tapered. The work is rounded off roughly and driven into the chuck. Fig. 20 shows a raised bar to assist in centering and holding the work. The work is rabbitted out at the parting line, the depth and width of the bar. This chuck is used in heavy work.

Patternmaker's face plates usually are faced with wood to prevent the tool from coming in contact with the iron. Since the wood is lighter than iron a higher speed may be used with greater safety. For that reason the iron plates are small and for large work the wood face is built up.

When pieces too thin for screws are turned, they may be fastened on with shellac. Some patternmakers use a mixture of 8 parts rosin to one of beeswax, which is applied in the same manner as the shellac. If the work is only several inches larger in diameter than the face plate, then a single board 1 to 2 inches thick screwed to the iron plate will be sufficient to hold the work. For example, if the face plate is 8 inches in diameter, a board 12 inches in diameter may be used. Above that and up to 20 inches, the board may be constructed as shown in Fig. 20 and for larger sizes made as seen in Fig. 2 and Fig. 3 or 4. More arms are needed as the size increases. Many prefer the type at Fig. 2 for all large sizes, it being cheaper and more easily constructed and is just as strong and rigid.

The chucks should be strong and rigid and in balance. If not, the tool probably will gouge into the work because of the tremor or vibration. All work should be fastened with screws. This will allow the wood to shrink or expand with the least warping.

Make New Appointments

H. O. K. Meister has been appointed general sales manager and A. W. Scarratt has been made chief engineer of the Hyatt Roller Bearing Co., Newark, N. J.

Ohio Foundrymen Meet

About 30 members attended the monthly dinner and meeting of the Ohio State Foundrymen's association held at the Hotel Cleveland, Cleveland on Feb. 14. Pat Dwyer, engineering editor, THE FOUNDRY, Cleveland, was the speaker of the evening. He described some of the ancient castings, commenting upon the ingenuity of the molders of that time and the difficulties with which they were handicaped. H. Cole Estep, Penton Publishing Co., Cleveland, said a few words on the attitude of the department of commerce toward trade associations.

Uses Nickel To Increase Machineability

Machineability of gray iron castings may be increased greatly by the addition of small amounts of nickel, according to D. M. Houston, International Nickel, Co., New York, who spoke before the February meeting of the New England Foundrymen's association. Mr. Houston stated that wherever straight gray iron castings would fill requirements, it was a mistake to use an alloy. He denounced the practice of using nickel or aluminum, or any other substance in gray iron castings to overcome faults in melting practice. However, under conditions which logically call for the use of nickel, it is expensive and unsatisfactory to attempt to achieve the results by manipulating silicon content or by any methods other than using nickel.

He advised going as far as possible in the direction of quality with the base metal, and then finishing with the proper addition of nickel or chromium. Nickel should be considered not as a cure for a sick iron, he stated, but as a means to secure greater tensile strength and machineability in an iron already of high quality. He cited a certain casting which was finished in the machine shop at the maximum rate of seven per hour when gray iron alone was used, and which, after the addition of ½ of 1 per cent nickel with other conditions the same, was finished at the rate of 16 per hour. This amount of nickel, that is, ½ of 1 per cent, Mr. Houston described as the machineable amount.

The addition of nickel in various quantities has a wide range of effect. It may be used to harden an iron or it may be used to soften an iron, depending upon the condition of the base metal and the amount added. Lantern slides illustrated the effect of different percentages of nickel in eliminating chill on a 2 x 4-inch chill block. One per cent nickel reduced the chill by about half, and it took 5 per cent to completely eliminate the chill.

High phosphorus iron according to Mr. Houston requires more nickel than low phosphorus iron to secure the same degree of machineability.

Harnischfeger Corp., Milwaukee, has removed its branch office at Jacksonville, Fla. from the Peninsular Casualty building to 509 East Eighth street. F. W. Truex is in charge. After March 1, the branch warehouse also will be located at this address.

He Holds the Pulse and
Prescribes for Ailing Cupolas

HE SPELLS it Geo. A. T. Long, but that simply is a hang over or a habit acquired during a brief and sketchy period spent in the schools of Chicago at a time when the city was just beginning to emerge from the tall prairie grass, to take a peek around and see for itself what it was all about. In a word reference is made to the closing years of the first of the two periods into which the history of Chicago always is divided. The years preceding the great fire of '71 and the years which have gone by since that memorable event.

George was born in 1858 and therefore had been in school long enough properly to appreciate the stroke of fortune for which all young scholars pray, but which only a comparatively small number ever actually live to see. The school house was swept away in the conflagration that almost wiped Chicago out of the swamp in which it was built. One of the real fires of history that licked up everything between the site of the present union station and the lake and from the Blackstone hotel to Lincoln park.

She Kicked the Bucket

The presence of a Mrs. O'Leary, a cow, a barn and a lantern in the territory adjacent to the union station seems highly incongruous to the modern visitor, but what is the petty skepticism of a few outsiders to the abiding faith in the story held by every one of the 3,000,000 loyal inhabitants of the city. The point never has been settled definitely whether the cow kicked the lantern accidentally, through sheer innate, bovine deviltry or in reprisal for some indignity, real or fancied, mental or physical, put upon her by the vigorous and possibly short tempered Mrs. O'Leary. Milking a cow, particularly in fly time has been known to ruffle the temper of people with more placid names than O'Leary.

The point really is immaterial. The only feature in which we are interested for the moment is that when the fire of 1871 burned itself out, practically every school house in the city had disappeared and thousands of frolicsome young scholars found themselves with a little more spare time than usual on their hands. George enjoyed a year of this halcyon form of existence and then at the mature age of 14 he started to serve an apprenticeship at the molding trade in the Union Brass & Iron Works, Chicago. The hour was 6 o'clock in the morning and the exact date was Oct. 25, 1872. Item, Geo. was on time.

His real name, or the name he would have if names were distributed after the Indian manner is Geo. C. D. Long which translated into the ordinary vernacular resolves itself into Geo. Cupola Doctor Long, foundry expert and adviser with the pig iron and coke firm of Pickands Brown & Co., Chicago. This company sells iron from three blast furnaces in Chicago and one in Duluth, by-product coke from Chicago ovens and from batteries in Milwaukee. This material is absorbed over a wide area. Whenever trouble of any kind develops in any of the foundries using this coke or iron, the patient telegraphs or telephones immediately for Geo. The doctor slips on the newest of his many new suits, runs down to the afflicted plant, runs a professional eye over the cupola inside and outside, the blower, the coke and the pig iron, puts the patient on a diet or orders a stimulant depending on circumstances and then trips lightly back to Chicago.

Where did he gather all the information that enables him to diagnose obscure cupola diseases so readily? Probably in your haste you failed to note the date on which Geo. first opened the book of knowledge. To refresh your memory it was in the fall of 1872. He has turned many pages since that time. He has had ample time to develop many theories and what is more important he has had ample opportunity to try them out in practice.

After serving four years with the Union Brass & Iron Works, Chicago, he moved to Detroit where he worked first in the old Hodge Iron Works and later in the foundry of the Michigan Malleable Iron Co. In 1890 he joined the Semet-Solvay Co., and started to introduce by-product coke to United States foundrymen about 1900. He also states that he originated the use of pitch compound as a core binder. He returned to Chicago in 1905 when the By-products Corp., built its plant and his connection with Pickands Brown & Co., practically dates from the same period since the two institutions are so closely related. In the early days of his trouble-shooting experience he spent from one-third to one-half of his time on the road. In recent years this time has been reduced to a considerable extent owing principally to improved cupola hygienic conditions introduced formerly. The greater part of his time now is spent in laboratory and research work.

Believes in Mild Blast

He is a strong advocate of low silicon iron to be melted with a mild blast and frequently finds occasion to scold some of his patients professionally for paying a premium for high silicon iron and then blowing the silicon up the stack with a blast strong enough for a bessemer converter. Probably he is the most widely known coke and pig iron man in the Middle West. Many customers merely specify the tonnage they require. They write in to the sales agent and tell him in effect that they need so many hundred or thousand tons of pig iron to meet their requirements for a certain period. Just like getting a pescription filled—a little more of the same. They depend on George to select and ship the grades best suited to their requirements. In effect they say "Geo! You're the doctor!"

Milestones in Foundry Progress

As Recorded in the March Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago

1897

APPRENTICESHIP was a subject of as wide and varied interest in the gay nineties as it is today. Herbert M. Ramp, discussing the question in THE FOUNDRY for March, 1897, repeated the question as to why the molders of that day were not the equal of those of the preceding generation. The author suggested that many of the objections to foundry training might be eliminated by making the foundry a better place in which to work.

* * *

Even in that time the influence of mechanical equipment upon the class of foundry labor was being felt.

* * *

An old timer told of pouring two pile driving hammers, one weighing 500 pounds and the other 1000 pounds. He had only a small cupola, so he bedded in the patterns, drew them and filled as much of the cavity of each mold as possible with scrap, mainly old sleigh shoes. The molten metal, as much as the cupola would melt, was poured around this mass of scrap.

* * *

RUTHLESS RHYMES

Timothy O'Toole casts cylinder blocks,
For a car with sales quite large.
If your motor knocks,
With jars and shocks,
It's hammers in the cupola charge.
A. V.

* * *

Poor firebricks and long heats never keep company for any length of time.

KRANK'S KORNER

* * *

The Philadelphia Foundrymen's association decided at its sixty-fifth meeting, held, Feb. 3, 1897 to refrain from attempting to establish a credit rating bureau as a part of its organization activities.

* * *

Western Foundrymen's association discussed the question of the proper amount of air in relation to the iron charge necessary in cupola melting.

* * *

Estimates varied from 25,000 to 40,000 cubic feet of air per ton of iron melted.

* * *

No. 2 foundry iron was selling at $10.75 to $11 a ton, Pittsburgh.

Faked Foundry Facts

Loose Parts

1907

BABCOCK & WILCOX CO. foundry at Barberton, O., was described in the March, 1907 issue of THE FOUNDRY. The foundry operated two cupolas and made castings for steam power plant service.

* * *

George C. Davis described a peculiar chilled casting made in a Philadelphia foundry.

* * *

H. N. Tuttle gave a detailed description of building segmental patterns.

* * *

Mr. Tuttle still is a valued contributor to THE FOUNDRY on pattern and molding subjects.

* * *

The products of 42 iron, steel and heavy machinery plants in Milwaukee during 1905 is given as in excess of $47,000,000. Of this about $6,000,000 represents the value of malleable products and hardware.

* * *

Foundries were operating at capacity and finding it difficult to secure sufficient iron. No. 2, Pittsburgh was quoted at $23.50.

* * *

This was immediately preceding the so-called money panic of 1907.

* * *

The formal call for a meeting of the American Foundrymen's association in Philadelphia gave the dates May 21 to 24 at the Second Regiment armory.

* * *

The United Foundry & Machine Co., Canton, O., was incorporated with an initial capital of $10,000 by George P. Bonsky and others.

* * *

General activity in the construction of new foundries was evidenced in the news of 1907.

1917

METHODS of making gray iron art work at the plant of Edwin A. Moore Iron Foundry, Reading Pa., were given in THE FOUNDRY of March, 1917. The work made included many different castings in deep relief designed for ornamental purposes.

* * *

Book ends, wall pockets, door stops and many items at present common in gift and stationery shops were apparently unknown ten years ago.

* * *

R. H. Palmer described the method of molding wheels and sheaves of gray iron with cast-in steel spokes.

* * *

Foundry practice developed by James A. Murphy, at the plant of the Hooven-Owens-Rentschler Co., Hamilton, O., formed the basis of an illustrated article on making heavy ammonia stills.

* * *

Vanadium bronze was specified for torpedo tube castings for submarine service. The formula required contained 60 per cent copper and almost 40 per cent zinc with only a small quantity of vanadium.

The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor

CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶ Back To the Farms

CONSIDERABLE interest recently has been shown by the electrical industry in extending the demand for its product in rural communities. Current consumption has increased in amazing amounts during recent years, but the development has been confined largely to cities, town and villages. It is estimated that about 6 per cent of the work on farms is performed electrically, while in urban centers, 60 per cent of the manufacturing operations are done by electricity. Similarly, only 8 per cent of the farms of the country are lighted by the "hot hairpin in a bottle," according to the slanderous description ascribed to the farmer some years back. Meanwhile electric lights predominate in 70 per cent of the town dwellings.

THE backwardness of farm localities in this regard is ascribed to the limited availability of current and to the difficulty of providing mobile power for the necessary mechanical operations on a farm. The former restriction is being reduced. The domestic type of electrical generator, consisting of a gasoline-driven generator with storage batteries, has done much to pave the way for wider use of electricity in rural establishments. Recently, central station interests have shown a willingness to take such installations in trade upon the cost of delivering current from their power lines and further to apply on the purchase price of sweepers, washing machines, refrigerators and other domestic electrical conveniences. Many times this has resulted in the use of such items by farmers, who otherwise might be satisfied to limit the use of central station power to lighting when it did become available.

FURNACE manufacturers and makers of plumbing, water supply, radiators, and sanitary ware doubtless are aware of the practically virgin territory for expansion of demand in rural communities. Some unified, consistent sales plan should be developed to incite interest and promote sales to farmers throughout the land. Mail order houses are adept at selling in this field, but the heating and sanitation items mentioned which, of course, embrace great quantities of foundry products, must compete in mail order catalogs with staple and fancy commodities, ranging from silk hose to radios. The job is primarily one for makers of the domestic necessities mentioned and should have attention from them.

¶ Simplification Cuts Waste

INCREASING rate of consumption of natural resources, resulting from enlarged demand on the part of the public for improvements in the comforts of life; increased costs of raw materials, labor, production and distribution; and the need for effective stabilization of the social structure are given as primary reasons for adopting simplified practice. The elimination of needless industrial waste must be practiced by manufacturers who expect to show a profit in their ledgers at inventory time. Increased costs of production and distribution may be reduced through simplified practice which eliminates or reduces large investments in special machinery, jigs, dies, and other equipment that quickly become obsolete.

ENGINEERS and designers can aid considerably to advance simplified practice by using standard designs for castings instead of striving for some mark of individuality that does not add to the efficiency of the machine, but often does increase the difficulties of molding the casting.

Early in 1926 the division of simplified practice, department of commerce, became interested in the value of weight indications on blueprints for castings and appointed a committee to lay plans. In April it was decided to send out questionnaires to interested parties, but no data are available as to the general prevalence of this particular phase of simplified practice. The question is of great importance to foundrymen for according to estimates, it will save the foundry industry $1,000,000 a year in the cost of making weight estimates. A problem of this type cannot be adjusted easily nor amicably unless all parties concerned are agreed, but it is hoped that 1927 will show further progress along this line.

Trade Trends in Tabloid

ALTHOUGH all indications point to an increase in castings demand with the advance of spring, January and February have been slack months in the foundry industry. Exceptions are found among some shops, notably those which are profiting from the increase of activity in railway equipment lines. Orders for freight cars during the latter part of February showed continued strength. The total for the third week of the month was in excess of 2500 cars. Freight loadings still are above the level for 1926. Automobile operations advanced sharply in January, compared with December and February probably will show a continued pickup. Increased demand for cast iron pipe is following the regular seasonal swing. A. J. Tuscany, secretary, Ohio State Foundrymen's association, reports January operations of foundries represented in that organization as 71.3 per cent of normal, compared with 82.4 per cent in December. Nonferrous activity also showed a drop in the first month of the year to 62.1 per cent of normal, compared with 69 per cent for December. In both instances the January rate is greater in 1927 than in 1926. Radiator shops are working at full capacity. Stove and furnace foundries are active. Early reports from the farm implement manufacturers indicate expectations of satisfactory business during the forthcoming summer.

RAW MATERIAL PRICES

Iron

Feb. 22, 1927

No. 2 foundry, Valley	$18.00 to 18.50
No. 2 southern, Birmingham	18.00
No. 2 foundry, Chicago	20.00 to 20.50
No. 2 foundry, Philadelphia	21.76 to 22.26
No. 2 foundry, Buffalo	19.00 to 19.25
Basic, Valley	18.00
Basic, Buffalo	18.50 to 18.75
Malleable, Chicago	20.00 to 20.50
Malleable, Buffalo	19.00 to 19.25

Coke

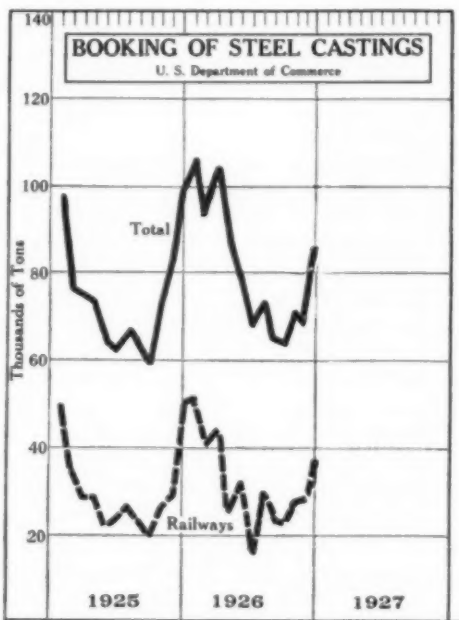
Connellsville foundry coke	$4.25 to 5.00
Wise county foundry coke	6.00

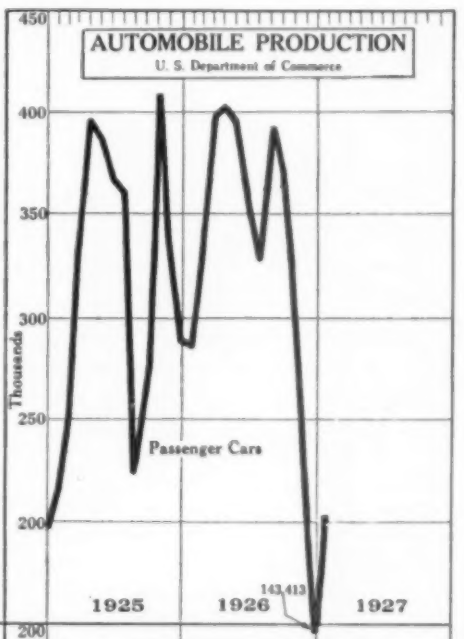
Scrap

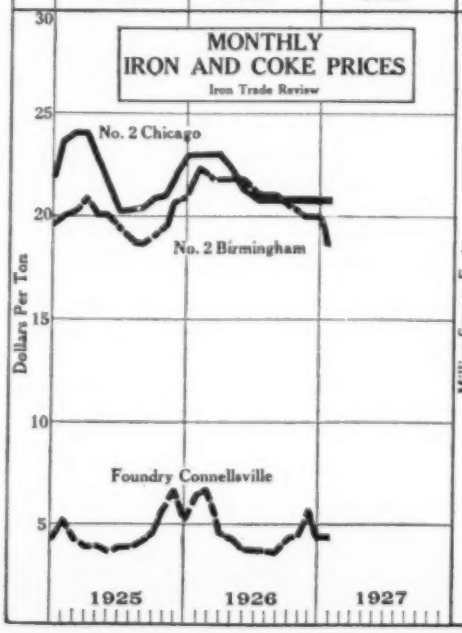
Heavy melting steel, Valley	$16.50
Heavy melting steel, Pitts.	15.75 to 16.25
Heavy melting steel, Chicago	13.00 to 13.50
Stove plate, Chicago	14.00 to 14.50
No. 1 cast, New York	14.00 to 14.50
No. 1 cast, Chicago	16.50 to 17.00
No. 1 cast, Philadelphia	17.00 to 18.00
No. 1 cast, Pittsburgh	15.50 to 16.00
No. 1 cast, Birmingham	16.00 to 17.00
No. 1 cast, Buffalo	16.25 to 16.75
Car wheels, iron, Pittsburgh	16.00 to 16.50
Car wheels, iron, Chicago	15.00 to 15.50
Railroad malleable, Chicago	16.00 to 16.50
Agricultural, mal., Chicago	15.25 to 15.75
Malleable, Buffalo	17.00 to 17.50
Railroad malleable, Pitts.	16.00 to 16.50

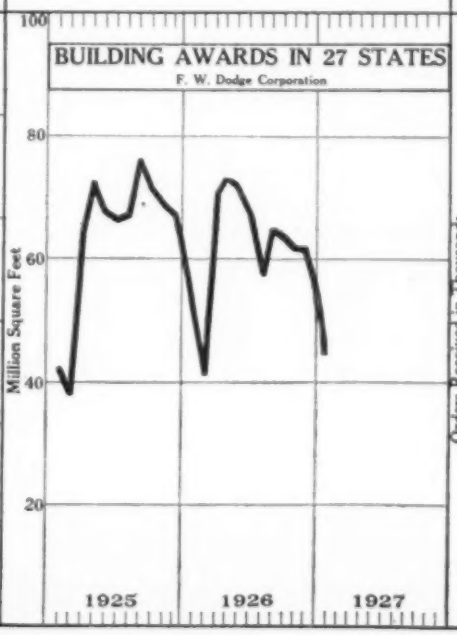
Nonferrous Metals

	Cents per pound
Casting copper, refinery	12.85
Electro copper, producers	13.00 to 13.12½
Straits tin	70.25
Lead, New York	7.50
Antimony, New York	14.25
Nickel, electro	39.00
Aluminum, No. 12, prod'rs	24.50
Aluminum, No. 12 remelt	20.50
Zinc, E. St. Louis, Ill.	6.25









Comings and Goings of Foundrymen

DR. ZAY JEFFRIES, Aluminum Co. of America and the General Electric Co., Cleveland, again was honored Feb. 16 when he was awarded the James Douglas medal for 1927 of the American Institute of Mining and Metallurgical engineers. The award was made "For Contributions to our Knowledge of the Hardness and Structure of Metals." Mr. Jeffries was born at Willow Lake, S. Dak., April 22, 1888. After completing his education in the high school at Pierre, S. Dak., he entered the South Dakota School of Mines from which institution he received the degree of B. S. in mining engineering in 1910. In 1914 he received the degree of metallurgical engineer from the same school. The degree of Doctor of Science was received from Harvard university, in 1918. After serving as manager of the Ideal Mining Co., Custer, S. Dak., in 1910-11, Mr. Jeffries joined the faculty of Case School of Applied Science, Cleveland, in 1911 as in instructor in metallurgy. In 1916 he was associate professor of the same subject. This connection was severed in 1917 when he became head of the Cleveland research bureau of the Aluminum Co. of America, a position which he still retains. Dr. Jeffries also is a consultant on research and development of the National Lamp Works of the General Electric Co., and consultant on research and metallurgy of the National Tube Co. During recent years he has contributed many papers technical societies. Dr. Jeffries is affiliated with the American Foundrymen's association, the American Institute of Mining and Metallurgical Engineers, Franklin institute, Farraday society, Institute of Metals of Great Britain, American Society for Testing Materials, Society of Automotive Engineers, American Physical society, American Society for Steel Treating, and Cleveland Engineering society.

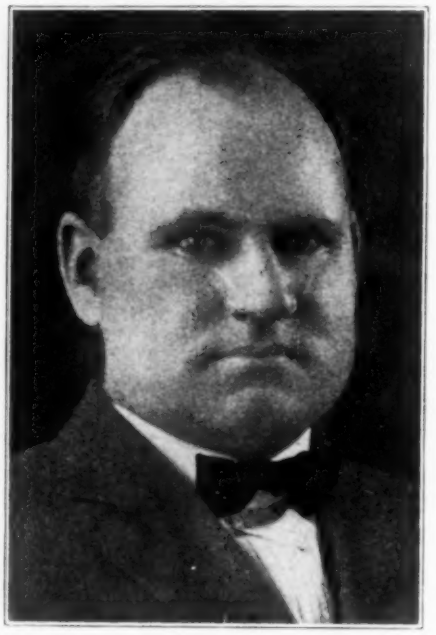
T. J. Cornwall has been elected president of the Foundrymen's association of Indianapolis.

Philip A. Koehring, secretary and treasurer, Koehring Co., Milwaukee, recently was re-elected president of the Milwaukee chamber of commerce.

Albert G. Wessling has been re-elected president of the Wessling Bros. Foundry Co., Cincinnati. Other officers named are George W. Piehl, vice president; Robert L. Kruse, treasurer, and Henry J. Weber, secretary.

Ernest V. Shaw, recently made works manager of the Artistic Bronze Co., Bridgeport, Conn., has been elected secretary and a director of the firm.

Edward B. Busby, formerly secretary-treasurer of the Monroe Steel Castings Co., Monroe, Mich., has become associated with Benjamin Dansard & Co., Detroit, investment bankers. He will be in charge of the newly organized industrial department.



ZAY JEFFRIES

A. C. Zimmerman, Symington Co., Rochester, N. Y., has been promoted to assistant general manager of the Gould Car Lighting Corp., also of Rochester. In addition Mr. Zimmerman will handle all electrical equipment problems of the Symington interests including the Gould Coupler Co., and the Gould Storage Battery Co.

George B. Darby Jr., who recently has become associated with the Soil Pipe association as noted in the Feb. 15 issue of THE FOUNDRY, had 4 years experience in the pressed steel industry previous to the World war, and served 3 years and 9 months in the army as a captain. In 1920 he became connected with the Lansdale Foundry Co. Inc., Lansdale, Pa., as production manager. Later he became secretary and treasurer, and sales manager of the firm.

William J. Woolley, formerly vice president of the Wolff Mfg. Corp., Chicago, plumbing and heating manufacturer, has been elected president to succeed the late Dr. J. T. Duryea, who died Jan. 30. Mr. Woolley was organizer of the National Trade Extension bureau, promoting sales in plumbing and heating industry. He also is vice president of the Pierce, Butler & Pierce Mfg. Corp., New York. Joseph A. Bower, vice president of the New York Trust Co., New York, has been named chairman of the Wolff financing committee.

Whiting Corp. Personnel Is Changed

Due to the addition of new lines and the acquisition of subsidiary companies, the Whiting Corp., Harvey, Ill., has made the following changes in its sales organization: R. H. Bourne, formerly vice president and sales manager, now is senior vice president and will devote his entire time to the sales of the Grindle Fuel Equipment Co., and the Joseph Harrington Co.; N. S. Lawrence, formerly vice president and assistant sales manager is now vice president and sales manager in charge of sales for Whiting Corp. and Swenson Evaporator Co. Mr. Lawrence will be assisted by A. H. McDougall, vice president and consulting engineer and R. E. Prussing, vice president in charge of district offices and agents of the company.

French Association Meets

Scientific Control of the Manufacture in Small and Medium Sized Gray Iron Foundries, was the subject of a paper presented by F. Girardt, at a meeting of the L'Association Technique de Fonderie at the School of Arts and Crafts, Paris, Jan. 20.

Dings Magnetic Separator Co., Milwaukee, has established a branch office at 304 Rice building, Boston. George H. Walsh will be in charge.

Obituary

William H. Roberts president, Roberts Brass Mfg. Co., Detroit, died unexpectedly Feb. 14 at his home from a sudden heart attack. Mr. Roberts was born in Wallaceburg, Ont., 48 years ago and came to Detroit with his parents when young. At Detroit the father established the company bearing his name, which Mr. Roberts and his brothers took over upon the retirement of the father. Mr. Roberts was identified prominently with a number of clubs in Detroit and in 1921 was the representative from Detroit at the international convention of Rotary clubs in Edinburgh, Scotland.

Charles E. Shadell, a mechanical engineer, one of the founders of the Nordberg Mfg. Co., Milwaukee, died Feb. 10. He was born at Kyrsklatt, Finland, April 11, 1859 and was graduated from the University of Helsingfors in 1879, coming to Milwaukee in 1883.

Henry Bradford Sargent, president and general manager of Sargent Hardware Mfg. Co., New Haven, Conn., hardware manufacturers, died in that city, Feb. 3. Mr. Sargent first entered the plant of the Sargent company as general inspector in 1872, later becoming assistant superintendent. The company was founded by his father, Joseph B. Sargent. He was made vice president in 1887, and in 1917 succeeded George Henry Sargent president. He was 76 years old.

Charles Deering, formerly chairman of the board of the International Harvester Co., Chicago, died at his winter home at Miami, Fla., Feb. 5, at the age of 75. He was born at Paris, Me., in 1852. Mr. Deering became chairman of the board following merger of several companies into the present organization.

WILLIAM H. ROBERTS

J. W. Johnson Is Dead

John William Johnson, civic and industrial leader of Kokomo, Ind., and associated with the Kokomo Brass Works and the Kokomo Malleable Iron Works Inc., died Jan. 30 following an operation. Mr. Johnson was born in Kokomo, Ind., Dec. 22, 1868 and received his education in parochial schools. At the age of 14 years he obtained his first steady employment, that of firing a boiler at the foundry and machine shop which later became known under the name Ford & Donnelly. Later on he entered the general shops of this firm and served his time as a molder. For a short time he worked in the Star Machine Works and then returned to Ford & Donnelly's where he spent 22 years.

In 1903 Charles T. Byrne and William Ryan who operated a plumbing specialty plant induced Mr. Johnson and George Kingston to join them in their venture and shortly thereafter the Byrne-Kingston Co. was incorporated. The firm flourished and today includes what is known in Kokomo as the Seven Allied Industries, composed of the Kokomo Brass Works, Byrne, Kingston & Co., Kokomo Electric Co., Hoosier Iron Works, Kokomo Stamped Metal Co., Kokomo Lithographic Co., and the Kokomo Malleable Iron Works Inc.

Mr. Johnson also was a director of several other firms in Kokomo.

Foundry Association Directory

American Foundrymen's Association

President, S. W. UTLEY, Detroit Steel Casting Co., Detroit; secretary-treasurer, C. E. HOYT, 140 South Dearborn street, Chicago; technical secretary, R. E. KENNEDY, 909 W. California street, Urbana, Ill.

The Buffalo Foundrymen
Buffalo

President, J. MCARTHUR, Washington Iron Works; secretary W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings the third Wednesday of the month at 146 Chandler street.

Chicago Foundrymen's Club
Chicago

President, G. H. ROLINSON, American Brake Shoe & Foundry Co., Chicago. Meetings second Saturday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, FRED W. STICKLE, Capitol Foundry Co., Hartford, Conn.; secretary, C. S. NEUMANN, Union Mfg. Co., New Britain, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association
Detroit

President, ROBERT G. CRAWFORD, Atlas Foundry Co., 131 South Artillery street, Detroit; secretary, RUSSELL M. SCOTT, Packard Motor Co., 1580 East Grand boulevard, Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

Metropolitan Brass Founders' Association
New York

President, WILLIAM EMBER, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary WILLIAM E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

President, J. L. CARTER, Barlow Foundry Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meeting called by president.

New England Foundrymen's Association

President, HENRY S. CHAFEE, Builders Iron Foundry, Providence, R. I.; secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio State Foundrymen's Association

President, WALTER L. SEELBACH, Walworth Run Foundry Co., 2488 West Twenty-seventh street, Cleveland; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Clieveland.

Philadelphia Foundrymen's Association
Philadelphia

President, WALTER WOOD, R. D. Wood & Co., Philadelphia; secretary HOWARD EVANS, Union League club, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association
Pittsburgh

President, LAWRENCE V. STEVENS, Locomotive Stoker Co. N. E. Pittsburgh; secretary-treasurer, WILLIAM J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association
Davenport, Iowa

President, J. H. DIEDRICH, Blackhawk Foundry & Machine Co., Davenport, Iowa; secretary-treasurer, A. D. ZIEBARTH, Davenport Foundry & Machine Co., Davenport, Iowa. Meetings the third Monday evening of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Southern Metal Trades Association
Atlanta, Ga.

President, GEORGE B. COCKER, Gastonia, N. C.; secretary, W. E. DUNN JR., Healy building.

Tri-City Technical Council
Moline, Ill.

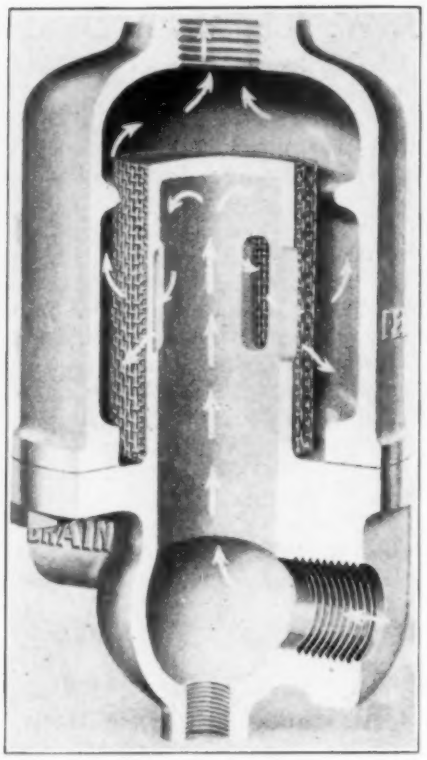
Chairman, H. BORNSTEIN, Deere & Co., Moline, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association
Cincinnati

President, HAROLD P. RITTER, John A. Oberhelman Foundry Co., 3323 Colerain avenue; secretary, GEORGE W. PIEHL, Wessling Bros. Foundry Co., 1607 McLean avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association
Minneapolis-St. Paul

President, J. A. TEACH, Minneapolis Steel & Machinery Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, So., Minneapolis. Meetings monthly at the Athletic club.



THE MOISTURE IS DEPOSITED ON THE COARSE BRASS SCREEN

Separates Moisture from Compressed Air

In a description of an oil and moisture separator made by the Smith-Monroe Co., 223 South Main street, South Bend, Ind., which appeared in the Jan. 15 issue of THE FOUNDRY, the illustration inadvertently was shown upside down. Since a clear understanding of the mechanical features depends on the illustration, the description and illustration are repeated in the interest of accuracy.

Compressed air carrying oil and moisture enters the separator through the horizontal inlet, shown by arrows in the accompanying illustration. The air travels upward to the top of the inner chamber where it is deflected downward and out horizontally through the slotted openings into the outer chamber. Many thicknesses of coarse brass screen surround the inner chamber, and serve to impede the flow of air through the opening, forcing it to follow a zigzag course through the screen to reach the outer chamber. This rapid change in direction in the short distance which the air travels, causes the moisture and oil to be carried beyond the air and deposited on the strands of screen. The moisture then falls into the dead air space at the bottom of the chamber.

Before the air leaves the outer chamber, it must pass around a projection cast in the upper part of the chamber. This chamber prevents any capillary action and maintains the air in the upper chamber free from moisture. The oil and water, which collect in the ring at the bottom of the chamber, drain off through a drop pipe in the shut-off valve. The operation may be made automatic by the use of a special trap which discharges the collected oil and water. The separators are made for either a ¾ or 1-inch line.

Rotor Is Cast Aluminum

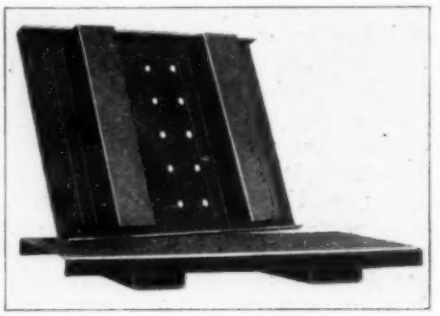
A new type of induction motor which is simple to operate, has been introduced by the General Electric Co., Schenectady, N. Y. The new motor is suitable for application wherever the ordinary squirrel cage induction motor with compensator has been used. It is designed to start on full voltage giving a slightly higher starting torque but approximately the same starting current as the ordinary squirrel cage induction motor starting with a compensator connected to the 80 per cent tap.

The appearance of the new motor is the same as the ordinary squirrel cage induction motor. The rotors are cast aluminum with bars so shaped and located in the punchings to give a high reactance effort in starting. A view of the rotor is shown in the accompanying illustration.

The control apparatus required is simple. An ordinary line switch of proper capacity may be used, but to obtain proper overload and undervoltage protection, the motors are recommended for use with magnetic starting switches using push button control. The motor is made in sizes ranging from 7½ to 50 horsepower.

Makes Bottom Board

An all steel bottom board recently has been placed on the market by the J. S. McCormick Co., 2428 Railroad street, Pittsburgh. The bottom boards are made with wide battens which



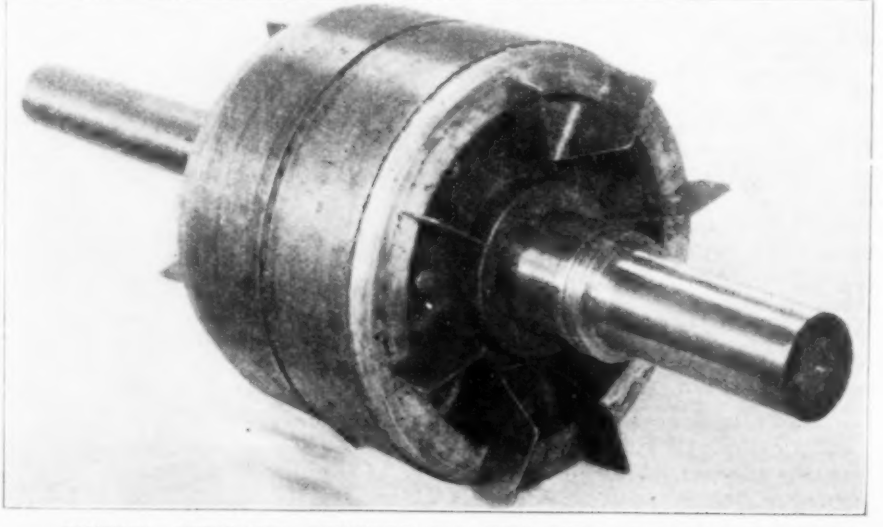
RUST RESISTING STEEL IS USED IN THE BOTTOM BOARDS

are welded to the bottom of the board. Theso battens, which are shown in the accompanying illustration, permit the board to rest solidly on the foundry floor. The width also prevents them digging into the dirt floor. The bottom boards are designed to prevent warping and are made of a rust resisting steel, which it is claimed adds materially to their life.

Appoints Representatives

Botfield Refractories Co., Philadelphia, has appointed the Southern Steel & Cement Co., Asheville, N. C.; Henry A. Petter Supply Co., Paducah, Ky.; Columbia Supply Co., Columbia, S. C., and the Spartanburg Mill Supply Co., Spartanburg, S. C., as distributors of its firebrick cement.

In 1925, $28,362,548 worth of aluminum castings were produced, according to a report of the department of commerce. These included motor vehicle accessories and parts.



CONTROL APPARATUS REQUIRED FOR THIS TYPE OF MOTOR IS SIMPLE

Western Foundrymen Show Interest in Foundry Meeting at the University of Wisconsin, Madison, Wis.

Wisconsin Holds Foundry Conference

By Ellis G. Fulton
(University Extension Division)

CURRENT problems and research developments in steel, malleable, gray iron, and nonferrous foundries were explored and discussed at the first annual foundry conference held at the laboratories of the University of Wisconsin, Madison, Wis., Feb. 1 to 4.

This conference was arranged in accordance with the policy of co-operation with the industries of the state, initiated three years ago by the college of engineering of the University of Wisconsin.

Leaders in the foundry industry, engineers and metallurgists of the university, and 78 representatives of 61 foundries in the states of Wisconsin, Minnesota, Illinois, Iowa, Ohio, Michigan, and Massachusetts took part in the conference. Prof. R. S. McCaffery, department of metallurgy, University of Wisconsin, was in general charge, with the co-operation of the college of engineering and the University extension division.

Features of the conference were an address by President Glenn Frank of the university; a steak supper on Tuesday and a *Brickbat* and *Bouquet* banquet on Thursday evening; noon luncheons in which the men met informally at the University club during each day of the sessions; a motion picture, followed by discussion, showing the triplex process of producing electric steel; demonstrations in the materials for testing laboratory; and inspection trips to the plants and foundries of the Gisholt Machine Co., manufacturers of machine tools, and the Madison-Kipp Co., manufacturers of lubricators.

Speakers at general meetings and leaders of round-table discussions were:

R. S. McPherran, Allis-Chalmers Mfg. Co., Milwaukee; H. W. Dietert, United States Radiator Corp., Detroit; William S. Ford and A. E. Murphy, William S. Ford and Co., Milwaukee; C. A. Busche, Prime Mfg. Co., Milwaukee; W. J. McNeill, Federal Malleable Co., West Allis, Wis.; A. T. Baumer, Milwaukee Steel Foundry Co., Milwaukee; C. I. Wesley, Wesley Steel Treating Co., Milwaukee; Carl Johnson, Gisholt Machine Co., Madison; and the following professors of the University of Wisconsin: F. E. Turneaure, dean, college of engineering; R. S. McCaffery, J. F. Oesterle, department of metallurgy; W. H. Dudley, university library; S. W. Gilman, department of economics.

Debate Pig Iron Quality

(*Concluded from Page* 185)

is most important. He said that the nature of scrap is changing, and that chromium and other alloys are being encountered more and more. The presence of copper in the cupola is not important, providing the iron mix already is high quality. Tests which Mr. Demorest made showed that there was no greater internal shrinkage or hardness through the addition of relatively small amounts of copper.

A paper by Enrique Touceda was presented for discussion although the author was not present at the convention. This paper advises the use of low total carbon iron for making malleable castings. Dr. Moldenke says high total carbon should be used for gray iron, and does not agree that low total carbon is essential to good malleable work. Bearing on this discussion Mr. Marks said that as far as he knew malleable foundries in England always use low total carbon iron. Several members of the pig iron group felt that it was not necessary to use steel scrap in foundry practice as Dr. Touceda suggests. One foundryman said that he has used malleable scrap, rail scrap and structural scrap with complete satisfaction in producing malleable castings. J. T. McKenzie recommended cold blast iron low in carbon for cupola malleable.

The pig iron session was of the unanimous opinion that a committee should be appointed to outline standard practice in testing pig iron and castings. Such practice would indicate the size and depth of a drill hole and just what chips were to be used, and also the section of the casting where microphotographs should be made.

Firm Removes Offices

The International Combustion Engineering Corp., New York, and its subsidiaries has removed its offices from 43 Broad street to its new building, the International Combustion building, located on Madison avenue between Thirty-fifth and Thirty-sixth streets. Subsidiaries of the company are: Combustion Engineering Corp., Ladd Water Tube Boiler Co., Raymond Bros. Impact Pulverizer Co. Inc.

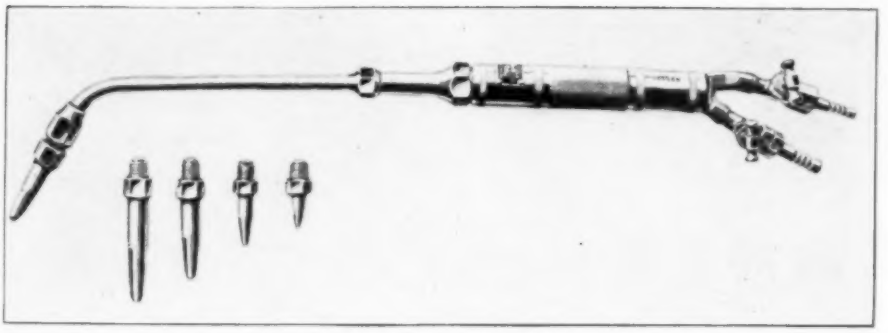
Builds Wheelbarrow With Interchangeable Tray

A number of unusual features have been incorporated in a line of wheelbarrows that is being manufactured by the Cleveland Wheelbarrow Co., Cleveland. As may be noted in the accompanying illustrations, the wheelbarrow is constructed with an extra bottom tray of 16-gage steel. The extra tray gives double the thickness of the tray supporting the load, prevents bolts pulling through the bottom of the tray and eliminates the necessity for long bolts. This extra thickness also prevents the tray from sagging and makes the chassis type of construction possible.

The chassis consists of a wheel, two wood or pipe handles depending on the requirements, the legs and front bottom brace, and the extra bottom tray. The extra bottom tray is attached to the handles with the same four bolts that hold the leg assembly. As shown in the illustration, the cross brace for the legs is curved. This feature prevents interference with the men pushing the wheelbarrow.

The wheel is malleable iron which will withstand heavy pressure. The wheel is provided with a grease pocket in the center of the hub which holds a 6 months' supply of grease. Grease is forced into the pocket through a cup, which also keeps out the dirt. Extended tire support is accomplished with specially designed spokes.

Interchangeability of the trays is a special feature of the wheelbarrow. The top tray is attached to the chassis with six bolts, two being fastened through the front braces and four through the bottom tray. The top may be removed quickly by removing the six bolts and any other tray mounted on the chassis.



THE GASES ENTER THE MIXING CHAMBER AT APPROXIMATELY EQUAL PRESSURES

Makes Welding Blowpipe

A new blowpipe, which recently has been placed on the market by the Oxweld Acetylene Co., 30 East Forty-second street, New York, is designed so that the oxygen and acetylene enter the inlets at about equal pressures. Gases are mixed thoroughly in the mixing chamber.

Stems for the blowpipe, which is shown in the accompanying illustration, are made in three lengths, namely 4, 9 and 19 inches. Each of the lengths is made in three angles, namely 45, 60 and 90 degrees. Any of these stems may be fitted to the handle part of the blowpipe simply by unlocking a union nut. The overall lengths of the blowpipe with the different stems are 15, 20 and 30 inches.

The welding blowpipe is simple in design. It is screwed together on all metal seats, with no soldered or packed joints. Thus any workman may disassemble and reassemble the unit easily when minor repairs are necessary.

Ten interchangeable tips, which are offered with the blowpipe, are made to withstand severe service. Nos. 3 and 4 are made of heavily plated copper brass and Nos. 5, 6, 7, 8, 9, 10, 11, and 12 of solid drawn copper. The proper oxygen and acetylene pressures to be used are stamped on each tip.

Addresses Chicago Club

Dr. John F. Keller, of the University Extension division, of Purdue university, will address the Chicago Foundrymen's club on Saturday evening, March 12. Dr. Keller will speak on "Why Iron and Steel Warp and Crack."

Michigan Foundry & Machine Co., Kalamazoo, Mich., has started operating a gray iron foundry for light and medium castings, with a capacity of about 12 tons per day.

The Double Tray Feature Provides Interchangeability

Equipment Sales Are Improving

Many Foundrymen, Anticipating Future Needs, Are Placing Orders for Machinery—Automobile Manufacturers Are Buying

CONSIDERABLE improvement has been noted in the market for foundry equipment during the past month. With few exceptions, sales of equipment in February exceeded the volume of business in January by a comfortable margin. In the Cleveland district the demand for sand preparing and conditioning equipment has been the outstanding feature of the market, while sales of molding machines have gained considerably. Buying for automobile plants in the Detroit district has been a noticeable feature during the past month.

Sales of equipment in the Chicago market improved greatly during the latter half of the month. Although foundry operations appear to be picking up, sales of equipment are increasing at a greater rate. A complete reversal of form has been noted in the Pittsburgh territory. After almost a complete absence of orders in January, foundrymen again are inquiring and placing orders for equipment, especially molding machines. The volume of inquiries which developed during the past two weeks is the largest of any similar period for a number of months. Two or three foundries want sand mixers, including one at Johnstown and one at McKeesport, Pa.

New England foundries generally are showing more interest in equipment. Both sales and inquiries improved moderately during February. Eastern sellers of equipment state that business is only fair. Little or no new construction has reached the stage where equipment purchases must be considered, so that buying principally is for replacements.

NEW YORK MARKET

Cranes

Continental Heater Co., Dunkirk, N. Y., one 5-ton crane from the Northern Engineering Works, Detroit.

General Electric Co., Schenectady, N. Y.; one 10-ton crane from the Niles Crane Corp., New York.

Furnaces

Nepperham Foundry Co., Yonkers, N. Y., one cupola; from the Whiting Corp., Harvey, Ill.

Molding Machines

Federal Foundry Co., Garwood, N. J., Hay Foundry & Iron Works, Newark, N. J.; Wheeler Condenser & Engineering Co., Carteret, N. J.; one each from the Herman Pneumatic Machine Co., Zelienople, Pa.

Sand Preparing Equipment

G. Methven & Co., Ltd., Dunedin, New Zealand, one large mixer with elevator; John Dunn Sons & Co., New York, one mixer with screen for export to Australia; Lynchburg Foundry Co., Radford, Va., batch mixer with elevator; Boynton Furnace Co., Jersey City, N. J., batch mixer with screen; from the Standard Sand & Machine Co., Cleveland.

G. Dikkers Co., Hengelo, Holland; Rider Erricsson Engine Corp., Walden, N. Y.; sand separators and blenders from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

Shakeout Equipment

Essex Foundry Co., Newark, N. J., special knockout machine for removing cores from pipe castings; Hanamag Co., Hannover-Linden, Germany, core knockout machine for cylinder castings; Elmira Foundry Co., Elmira, N. Y., vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland.

PITTSBURGH MARKET

Cranes

National Radiator Co., New Castle, Pa., three cranes; United Engineering & Foundry Co., Pittsburgh, one 10-ton, 4-motor crane; from the Milwaukee Electric Crane & Mfg. Co., Milwaukee.

Furnaces

Wildman Mfg. Co., Norristown, Pa., one cupola, from the Whiting Corp., Harvey, Ill.

Ladles

National Tube Co., Elwood City, Pa., one worm geared ladle from the J. S. McCormick Co., Pittsburgh.

Molding Machines

Jones & Laughlin Steel Corp., Southside Works, Pittsburgh; from the Herman Pneumatic Machine Co., Zelienople, Pa.

Sand Preparing Equipment

Fuller-Lehigh Co., Fullerton, Pa.; Pittsburgh Valve Foundry & Construction Co., Pittsburgh, Reading Brass Works, Reading, Pa.; Reading Iron Co., Reading, Pa.; Treadwell Engineering Co., Easton, Pa.; sand separators and blenders from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

Sharon Foundry Co., Sharon, Pa.; Southern Wheel Co., Portsmouth, Va., sand mixers from the National Engineering Co., Chicago.

Shakeout Equipment

Stanley G. Flagg & Co., Stowe, Pa., Conemaugh Iron Works, Blairsville, Pa., vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland.

NEW ENGLAND MARKET

Furnaces

General Electric Co., West Lynn, Mass., one cupola, from the Whiting Corp., Harvey, Ill.

Molding Machines

Henry Perkins Co., Bridgewater, Mass., one; Fritzell Foundry Co., New Haven, Conn., three jar squeezers; Gilbert & Barker Mfg. Co., Springfield, Mass., three; Manufacturers Iron Foundry, Bridgeport, Conn., three jar squeezers, from the Tabor Mfg. Co., Philadelphia.

Sand Preparing Equipment

U. S. Navy Yard, Boston, sand separator and blender from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

CHICAGO MARKET

Core Ovens

International Harvester Co., Milwaukee, continuous conveyor type core oven; Buick Motor Car Co., Flint, Mich., nine large conveyor type core ovens; from the Young Brothers Co., Detroit.

Furnaces

Standard Foundry Co., Racine, Wis., one cupola; Caterpillar Tractor Co., Peoria, Ill.; one cupola; Crane Co., Chicago, one cupola; from the Whiting Corp., Harvey, Ill.

Molding Machines

Griffin Wheel Co., Salt Lake City, Utah, two; American Manganese Steel Co., Chicago Heights, Ill.; Josam Mfg. Co., Michigan City, Ind.; Weil-McClain Co., Michigan City, Ind.; from the Herman Pneumatic Machine Co., Zelienople, Pa.

Lakey Foundry & Machine Co., Muskegon, Mich., two jolt-squeeze-strip molding machines from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Sand Preparing Equipment

Buick Motor Car Co., Flint, Mich., six large mixers with screen; Saginaw Products Co., Saginaw, Mich., one large mixer with elevator; from the Standard Sand & Machine Co., Cleveland.

John Deere Harvester Works, East Moline, Ill.; Richmond Malleable Castings Co., Richmond, Ind.; Spring City Foundry Co., Waukesha, Wis.; Whiting Corp., Harvey, Ill.; sand separators and blenders from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

South Side Malleable Castings Co., Milwaukee; Keokuk Steel Castings Co., Keokuk, Iowa, sand mixers from the National Engineering Co., Chicago.

Shakeout Equipment

Lakey Foundry & Machine Co., Muskegon, Mich., three core knockout machines for cylinder castings; Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., Holmes Foundry Co., Port Huron, Mich., John Deere Tractor Co., Waterloo, Iowa, vibrator and shakeout equipment; Griffin Wheel Co., Salt Lake City, Utah, three shakeout bails from the Stoney Foundry Engineering & Equipment Co., Cleveland.

CLEVELAND MARKET

Molding Machines

Griffin Wheel Co., Cincinnati, two; American Casting Co., Birmingham, Ala., one; U. S. Cast Iron Pipe & Foundry Co., Addyston, O., one; from the Herman Pneumatic Machine Co., Zelienople, Pa.

Ferro Machine & Foundry Co., Cleveland, four overhead ram vibrator molding machines from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Sand Preparing Equipment

American Radiator Co., Buffalo, one large mixer with elevator; Central Specialty Co., Detroit, batch mixer; Gluntz Brass Foundry Co., Cleveland, small mixer with screen; from the Standard Sand & Machine Co., Cleveland.

Babcock-Wilcox & Goldie-McCulloch Ltd.,

Galt, Ont.; Buckeye Iron & Brass Works, Dayton, O.; Farrell-Cheek Steel Foundry Co., Sandusky, O.; Frontier Iron Works, Buffalo; Nolte Brass Foundry Co., Springfield, O.; sand separators and blenders from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

Shakeout Equipment

Wilson Foundry & Machine Co., Pontiac, Mich., five shakeout bails; Fox Furnace Co., Elyria, O., one shakeout bail; Griffin Wheel Co., Cincinnati, three shakeout bails; American Radiator Co., Buffalo, Ferro Machine & Foundry Co., Cleveland, Grabler Mfg. Co., Cleveland, Henry Furnace Co., Medina, O., vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Detroit Brass & Malleable Iron Works, Holden avenue, Detroit, will build a 1-story addition to its factory.

Grabler Mfg. Co., Cleveland, will construct a one-story addition at an estimated cost of $40,000.

Magnavox Co., Oakland, Calif., has purchased the Western Aluminum Mfg. Co. of Emeryville, and will erect a new plant.

W. R. Hodges has leased the building of Loggins Lumber Co., Winona, Miss., which will be repaired and remodeled into a foundry and machine shop.

Sellersville Foundry and Machine Co., Sellersville, Pa., R. J. Vogel, manager, plan the extension of their plant to increase their production.

Patterson Foundry & Machine Co., Walnut street, East Liverpool, O., R. L. Cawood, president, plans to erect a new plant on the five-acre plot recently acquired.

Smith & Caffrey Co., 2613 Lodi street, Syracuse, N. Y., manufacturer of iron castings, has awarded the general contract for a 1-story addition 40x100 feet, to Jenks & Venton, of Syracuse.

C. F. Braun & Co., Alhambra, Calif., has started work on its new foundry. The foundry, 300x380 feet, will be separated from the main factory. The present force of employes will be nearly doubled.

Up-to-Date Pattern Co., 901 North Spring street, Los Angeles, manufacturer of metal and wood patterns, has given contract to Joseph Schuck, 1223 West Sixty-first street, for a 1-story plant 80x120 feet.

Connellsville Mfg. & Mine Supply Co., Connellsville, Pa., makers of mining equipment, will build a 1-story plant 130x240 feet. Austin Co., Pittsburgh has been let the general contract.

Montpelier Foundry & Machine Co., Fort Wayne, Ind., has been incorporated to succeed the Montpelier Mfg. Co., Montpelier, Ind., and will continue the manufacture of gray iron castings.

Lavelle Foundry Co., Lavelle, Ind., has elected the following directors: T. A. Lavelle, B. J. Lavelle, J. J. Lavelle, L. Lavelle, H. B. Laughlin, P. B. O'Neill and A. T. Dye.

Crucible Steel Casting Co., H. F. Tielke, secretary, West Eighty-fourth street and Almira avenue, Cleveland, has let the contract for a 1-story foundry addition and sand storage building 102x160 feet, to C. A. Carson Co., 5716 Euclid avenue.

The Ann Arbor Machine Co., Shelbyville, Ill., L. R. Tallman, general manager, has decided to dispose of its gray iron foundry. The company no longer will operate this foundry for its own requirements and does not desire to enter the general jobbing field.

A. W. Cadman Mfg. Co., Pittsburgh, having sold its valve business, will reconstruct its valve finishing plant for enlargement of its brass and bronze foundries and install machinery and equipment, trebling its capacity.

The Magee Furnace Co., Taunton, Mass., is moving its foundry to Troy, N. Y., and will start operations there about June 1. Part of the business, including selling and warehousing will be retained in Taunton for the present.

The Chicago Pneumatic Tool Co., New York, will start construction of a new foundry at Franklin, Pa., this spring. The new plant is to be several hundred feet long and will employ approximately 500 men, specializing in the manufacture of refrigerators and diesel engines.

New Jersey Foundry & Machine Co., manufacturer of conveying equipment and steel fabricator, has moved its general offices from 90 West street, New York, to a recently erected office at its plant in Garwood, N. J. R. Irwin will remain as sales representative at the West street location.

Howe Scale Co., Rutland, Vt., has bought the Weightograph Co., St. Louis, and plans are being made to consolidate operations of both in the plant at St. Louis. The Howe Scale Co. was established in 1857 and is one of the oldest and largest manufacturers of scales in the country.

Sweet & Doyle Foundry & Machine Co. stockholders, Green Island, N. Y., have elected the following officers: President, John E. MacLean; vice president, Harry M. Sweet; secretary, Ray S. Latimer; assistant secretary, Frank W. Neary; treasurer, Edward C. Doyle. The officers constitute the board of directors.

Marion Foundry Co., Marion, O., re-elected all the officers and directors at the annual meeting. The directors re-elected are: William Ring, E. C. Harraman, William Haberman, L. A. Harraman and C. A. Bolin. Officers re-elected are: President, Mr. Ring; vice president, Mr. Haberman; secretary-treasurer, Mr. Bolin.

United States Radiator Co., Dunkirk, N. Y., will begin a rebuilding program on a large scale at once, including extensive modernization. The first step will be construction of a fireproof foundry 160x269 feet. It will be built around the present foundry with no interruption to production. Later new warehouse, shipping and storehouse units will be constructed.

Pittsburgh Steel Foundry Co., Pittsburgh, has elected officers and directors as follows: Stewart Johnston, chairman; J. B. Black, H. Darlington Jr., and G. A. Hassel, C. W. Howat, J. M. Lockhart, J. H. Lockhart, C. McK. Lynch, F. A. McCune and L. W. Smith. Officers elected are: President, G. A. Hassel; vice presidents, C. W. Howat and J. E. Rew; secretary and treasurer, John Bright.

Athens Stove Works, Athens, Tenn., has elected the following directors: G. F. Lockmiller, E. G. Fisher, C. L. Williams, Dr. C. A. Beard, J. G. Fisher, R. J. Fisher, K. B. Watson, E. L. Wilson and A. E. Walthall. Officers elected are: President, R. J. Fisher; vice president, Mr. Walthall; secretary, treasurer and general manager, Mr. Williams, assistant manager and superintendent, Mr. Watson.

Franklin Die Casting Co., Syracuse, N. Y., has elected F. A. Barton president, to fill the vacancy caused by the death of Howard Franklin. Mr. Barton is treasurer of the H. H. Franklin Mfg. Co. Other officers elected are: Vice president, G. H. Stilwell; secretary and treasurer, C. E. Hull; manager, B. H. Gilpin. Directors of the corporation are: H. H. Franklin, Mr. Stilwell, Mr. Barton, E. H. Dann, H. H. Goodhart and G. E. Halligan.

Belle City Mfg. Co., Racine, Wis., is about to resume work after idleness of about six weeks. Samuel Nicols of St. Louis has taken charge of affairs as general manager, succeeding F. Lee Norton, who resigned a short time ago. A quantity of manufactured product, including individual threshing machine outfits and crawler attachments for tractors, is being disposed of, and a start has been made in working up into manufactured product a considerable stock of new material in the warehouses.

Negotiations which have been pending for ten days with respect to control of the important Massey-Harris implement concern with headquarters in Toronto, Ont., and plants in various cities including Batavia, N. Y., have been concluded and the control will remain in Canada, it is said. Control appears to have been gained by a group headed by Thomas Bradshaw, vice president and general manager of the company, and J. H. Gundy, Toronto investment banker. It is understood two groups of United States implement manufacturers were bidding for the stock. The understanding is that Hon. Vincent Massey, newly appointed Canadian minister to Washington, has sold his holdings of 75,000 shares to the Toronto group at $110 for the preferred stock and $125 for the common stock. J. N. Shenstone is to remain as president of the company, it is said, and there will be no reorganization or recapitalization of the company, and no further changes among the officials of the organization.

New Trade Publications

LUMBER—The Sugar Pine Sales Co., San Francisco, has published an 18-page catalog describing sugar pine from forest to finished product in the pattern shop. The physical properties, methods of manufacturing into lumber, grades and recommendations for use are given. Illustrations show the various types of patterns made from this lumber.